Project Update: December 2017

Abstract
Palaeoenvironment evolution in Africa, has shown that tropical forests were reduced to small refugial areas that are in a state of constant isolation. These refugial areas are among species-rich ecosystems of the Dahomey Gap savannahs in West Africa. This is the case of Ewe-Adakplame relict forest that shows an insular characteristics in the south of Benin. However, its floristic composition is not yet comprehensively known and it is thus difficult to estimate its potential for biodiversity conservation. This study provides details on the list of vascular plants, their life forms and chorology by means of 73 points of observation including 25 plots (10m X 50m) of vegetation surveys. We recorded 180 species belonging to 54 families and 142 genera. Of these, the Rubiaceae family was the most speciose (20 species) followed by the Fabaceae (15 species). Life forms showed the preponderance of phanerophytes (88%) and the Chorological spectrum was dominated by Guineo-Congolian species (66%). Species richness estimation using Bootstrap, Chao, Jacknife (1&2) ranged from 200.52 to 242.67. Plant species such as *Nesogordonia papaverifera*, *Mansonia altissima* and species of tribe Drypeteae are among taxa found nowhere else in Benin. The uniqueness of this forest islet which evolves in a matrix of savannah-dominated vegetation justifies the need to develop better strategies for its conservation.

Key words: Dahomey Gap; Guinean endemics; Forest Species; West Africa.

Introduction
In West Africa, relict forests are among the most species-rich ecosystems, and are considered as refuges for many range-restricted species (Aubréville, 1937; Juhé-Beaulaton, 2010; Adomou et al., 2010). They are the last remnants of tropical rain forest that existed during the humid periods of the early to mid-Holocene (8500-4000 years BP) (Tossou, 2002; Salzmann and Hoelzmann, 2005). Within the Dahomey Gap, which is the remarkable dry corridor separating the West African rain forest into the Upper and Lower Guinean forest (White, 1983; Jenik, 1994), many rare and poorly known plants are highly concentrated in these isolated forest fragments (Kokou and Sokpon, 2006). These fragments are also seen as sources of supply of forest products (food, firewood, handicrafts, traditional medicine, construction, fiber, symbolic uses, and picking for trading) essential for local populations, and especially as seed sources for forest recolonization or 'stepping stones' for gene flow between large protected areas via connection phenomena (Martin, 2008). However, some of them are now heavily threatened by habitat degradation, linked to the inescapable increasing human impact (leading to extensive agriculture) and above all, to the lack of adequate measures of conservation. Adomou et al. (2006) underlined the case of Ewe-Adakplame relict forest (EARF) which is under severe threat in the savannah-dominated area of Benin. Of the fifteen remnant tropical moist forest fragments in Benin, EARF accommodates a unique species composition, including globally endangered and vulnerable plant species (Adomou et al., 2010). Aubréville (1937) described EARF as a nature reserve islet, or a woodland-refuge from tribal wars, with difficult access, particularly thick, and which contains many of the Guineo-Congolian plant species previously described in Côte d'Ivoire's semi-deciduous forests. Up to now, the case of Ewe's semi-deciduous forest relict continues to captivate conservationists' attention. Adomou et al. (2010) pointed out that EARF deserves urgent conservation measures since it is home to many range-restricted plant species found nowhere else in Benin. Adomou et al. (2009) emphasized the

uniqueness of the *Mansonia* community in Benin and its restriction to the EARF. It extends over 400 ha on community land and shows insular characteristics, with a tract of relatively undisturbed and poorly described vegetation. Nonetheless, EARF has not yet been prioritized for conservation at the national level and is still entirely managed locally without any formal conservation and management plan. Unlike national parks and state-owned gazetted forests in Benin, this forest relict remains entirely unprotected and is not a sacred forest. Therefore, it is urgent to assess the floristic potential of EARF and to prioritize the plant species to be conserved.

This paper aims to provide a preliminary list of vascular plant species as a tool for long lasting management and conservation of the EARF. Knowledge of the vascular plant community is also vital for the process of palaeo-vegetation reconstruction. It is expected that this checklist will help to assess the current status of this forest, while serving as baseline information for understanding the history of the vegetation over millennia.

Methods and materials

- Study site

The Ewe-Adakplame relict forest (EARF) is located in Ketou District, in the south-east of Benin Republic, within the Guineo-Congolian Region (White, 1983; Adomou et al., 2006) at latitude 07°27'59.195" N, longitude 002°34'29.395" E (Figure 1). The EARF lies to the north-east of the depression of "Co" or "Lama" on the plateaus of low altitude that evolved on the pre-Cambrian base rocks (Adjanohoun et al., 1989). EARF is neither a state gazetted forest nor a sacred forest although the relict is established on local community land. It is also completely isolated from the national protected areas network, most of which are restricted to the national parks in northern Benin. The Lama Forest is the only protected and well-managed forest in southern Benin (Adomou et al., 2006).

The mean annual rainfall in the EARF is between 900–1300 mm in contrast to other similar African dense semi-deciduous forests. The rainfall recorded in the Upper Guinea is between 1750–1900 mm (Martin, 2008) in Côte d'Ivoire (West Africa) and annual rainfall measured around the Kakamega rainforest in East Africa was approximately 2215 mm (Cords, 1987) and 1956 mm (Greiner, 1991). Table I provides parameters such as temperature, relative humidity, vegetation and soil types of the study site.

The EARF is sandwiched by areas experiencing two important types of anthropogenic pressure. In the south-west on the edge of the two villages (Ewe and Adakplamè), the northwards extension of new settlements and nearby fields threaten the forest. In the north-east, away from the two villages, damage is increasingly due to the development of plantations. It has long been under severe threats from agriculture and logging but is still a haven for threatened plant species. From 572 ha in 1987, the EARF was reduced to about 364 ha by 2007. During those years, encroachment due to human activities cleared 36.24% of the forest area that was once a stronghold for the tree cover (Houngnon, 2014). This narrowing of natural habitat led to the reduction in biomass and food resources for wildlife. Given this habitat loss, most of the extraordinary biodiversity hosted by EARF can be regarded as at greater risk of extinction than expected. However, forest extension is now underway with a current coverage of about 400 ha. The landscape surrounding

EARF is dominated by fallows, cultivation areas and housing and the vegetation is a mosaic of savannah with species of the Sudanian transition zone. The total population of the villages of Ewe and Adakplame is 13,623 individuals in 2,078 households (INSAE, 2016). The main activity is agriculture followed by hunting, livestock breeding and local market.

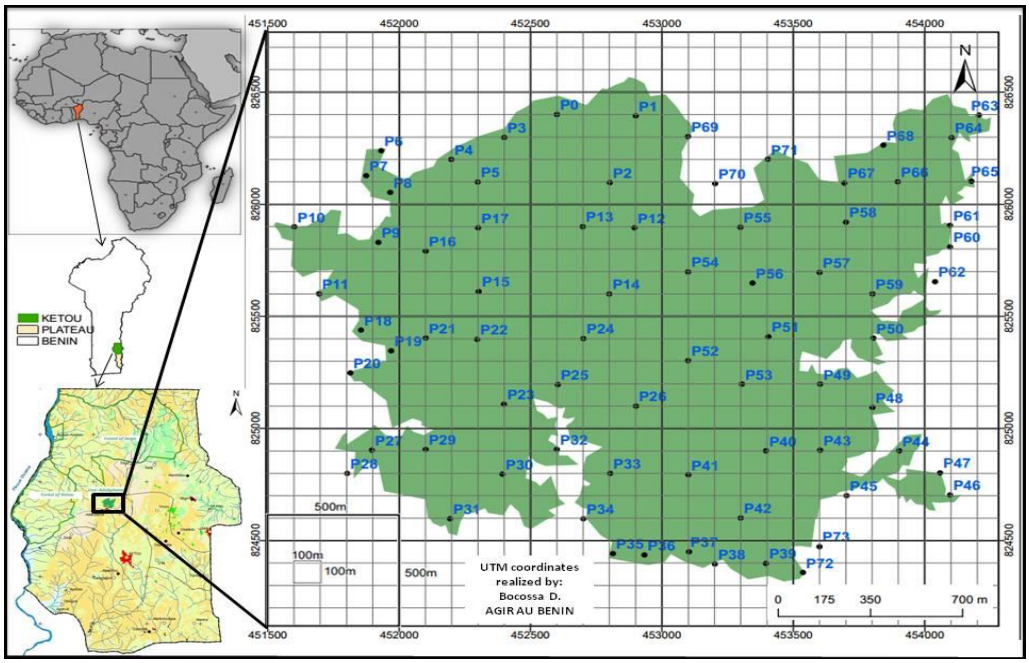

FIGURE 1. Location of the Ewe-Adakplame relict forest in Benin and positions of the sampling stands.

Table I. Ecological characteristics of the study region.

Location	6°25–7°30 N	Adjanohoun et al., 1989; Adomou et al., 2006
Annual rainfall	900–1100 mm	CARDER, 2002; Adomou et al., 2006
Rainfall trend	Bimodal	Adjanohoun et al., 1989;
Rainy season(s)	March–July & September–October	Adjanohoun et al., 1989; Adomou et al., 2006
Dry season	August and November–February	Bani, 2006
Temperature	24–37°C	CARDER, 2002; Bani, 2006
Insolation	2135 h	CARDER, 2002; Bani, 2006
Relative humidity	78–95%	CARDER, 2002; Bani, 2006
Climate type	Sub-equatorial	Adomou et al., 2006
Length of plant growing season	240 days	CARDER 2002; Bani, 2006
Vegetation	Semi-deciduous forest	Adjanohoun et al., 1989; Adomou et al., 2006
Soil types	Ferralitic soils without concretion	Adjanohoun et al., 1989; Bani, 2006
Altitude	200–286 m above sea level	Bani, 2006

- Data collection

The inventory of EARF plant species was conducted from 2014 to 2017. The forest investigation was based on a vegetation map divided into 250,000 m² (500 m * 500 m) grids following 6 transects, each of 500 m width and 3000 m length. The transects were oriented south-north. The floristic sampling covered 73 points of observation where species occurrence was recorded (Figure 1). At each stand, a topometer (Chaining Buddy, Fremaco Devices, Canada) with disposable filament was used to delimit quadrats of 500 m² (10 m * 50 m) depending on the variation of dominant species, accessibility and degree of slope. The observation stands were set out at intervals of 100 m along each transect line and there was one quadrat per plot of 250,000 m². In total, 25 forest quadrats of 500 m² were floristically surveyed; data collection followed Braun-Blanquet (1972). Voucher specimens were systematically collected, mounted onto herbarium sheets, and deposited at the National Herbarium of Benin. The botanical nomenclature followed the Analytical Flora of Benin (Akoègninou et al., 2006).

Data treatment

- Floristic composition

The taxonomic plant diversity was assessed in terms of species, genus, and family richness. Life forms assessment followed Raunkiaer (1934) and Hutchinson and Dalziel (1954–1972): Ph: phanerophytes subdivided into meg: megaphanerophyte (> 30 m tall), mes: mesophanerophyte (8-30 m), mph: microphanerophyte (2-8 m), nph: nanophanerophyte (0.5-2 m); Ch: chamaephyte, Hc: hemicryptophyte; Th: therophyte; G: geophyte (Gb: with bulb, Gr: with rhizome and Gt: with tuber); Ep: epiphyte and their climbing forms L: liana (Lmph, Lnph and Lmes, LGr, LHc).

The phytogeographic types were established after Hutchinson and Dalziel (1954–1972) and White (1983), as follows: GC: Guineo-Congolian, SG: Sudano/Guinean transition, SZ: Sudano-Zambezian, GE: Lower Guinean, GO: Upper Guinean, TA: Tropical Africa, PRA: Pluri-Regional in Africa, AM: Afro-Malagasy, Pan: Pantropical. PRA, AM and Pan are grouped in the category of 'wide distribution'.

- Species richness estimations

The species richness (S) corresponds to the number of species recorded from sample plots. We used the functions "specpool" and "estimateR" in R (R Core Team 2016) to reduce bias in the observations (Palmer, 1990; Colwell & Coddington, 1994; Chiu et al., 2014). Chao, first order jackknife, second order jackknife and bootstrap were used to estimate the total number of species surveyed and to draw species accumulation curves (R Core Team, 2016; Oksanen et al., 2017).

Results

- Floristics

A total of 180 plant species were recorded from 54 families and 142 genera in EARF (Figure 2). Of these, nine families had a minimum of five species (Table II). Rubiaceae was the most speciose family with 20 species, followed by Fabaceae (15), Malvaceae (13), Apocynaceae (12), Sapindaceae (8), Annonaceae (7), Capparaceae, Celastraceae and Dioscoreaceae were each represented by 5 species. Forty-three percent of the families (23) were represented by one species each. Only the genus *Dioscorea* was represented by 5 species followed by genera

Albizia, Cissus, Strychnos (4 species each) and *Celtis, Diospyros, Drypetes, Rinorea, Zanthoxylum* (3 species each).

The most common species include *Drypetes gilgiana* (Pax) Pax & K. Hoffm, *Triplochiton scleroxylon* K. Schum., *Englerophytum oblanceolatum* (S. Moore) Pennington (Syn. *Bequaertiodendron oblanceolatum*), *Mansonia altissima* (A. Chev.) A. Chev. var. *altissima*, *Uvariopsis tripetala* Bak. f. (Syn. *Dennettia tripetala*), *Ceiba pentandra* (L.) Gaertn., *Anchomanes difformis* (Blume) Engl.(Syn. *Anchomanes welwitschii*) Rendle, *Abrus precatorius* L., *Vitex micrantha* Gurke, *Momordica charantia* Benth., *Dioscoreophyllum cumminsii* (Stapf) Diels, *Nesogordonia papaverifera* (A. Chev.), *Drypetes aframensis* Hutch., *Pancovia bijuga* Willd., *Drypetes floribunda* (Müll. Arg.) Hutch., *Octolobus spectabilis* Welw. (Syn. *O. angustatus* Hutch.), *Celtis philippensis* Blanco (Syn. *C. brownii*), *Pouchetia africana* DC., *Celtis zenkeri* Engl., *Salacia pallescens* Oliv., *Antiaris toxicaria* Lesch. (Syn. *A. africana*), *Celtis mildbraedii* Engl., *Dialium guineense,* Wild., *Maerua duchesnei* (De Wild.) F. White (Syn. *Ritcheia duchesnei.*), *Stachyanthus occidentalis* (Keay & Miège) Boutique (Syn. *Neostachyanthus occidentalis* Keay & Miège), *Trichilia prieureana* A. Juss. (subsp. *prieureana*). Some of these plant species are featured in Figure 3. A-K.

- Life form spectrum

The most common life forms were phanerophytes (88%, including 33% of lianas), geophytes (6%) and 6% for chamaephyte, therophyte, epiphyte, hemicryptophyte. (Figure 4). The microphanerophytes were found to be most representative among phanerophytes. The tree layer was discontinuous and composed of *Celtis mildbraedii* (Cannabaceae), *Triplochiton scleroxylon* (Malvaceae), *Antiaris toxicaria* (Moraceae), *Celtis zenkeri* (Cannabaceae), *Dialium guineense* (Fabaceae), *Ceiba pentandra* (Malvaceae), *Mansonia altissima* (Malvaceae), *Milicia exelsa* (Moraceae), and *Nesogordonia papaverifera* (Malvaceae).

- Phytogeographical affinity of Ewe-Adakplame relict forest

The most representative chorotypes (Figure 5) included Guineo-Congolian species (66%), followed by the "wide distribution" species (14%). Upper Guinea species included plants such as *Uvariopsis tripetala* Bak. f. Syn. *Dennettia tripetala* (Annonaceae), *Drypetes aframensis* Hutch. (Putranjivaceae tribe Drypeteae), *Stachyanthus occidentalis* (Keay & Miège) Boutique Syn. *Neostachyanthus occidentalis* Keay & Miège (Icacinaceae), *Lannea nigritana* (Sc. Elliot) Keay var. *nigritana* (Anacardiaceae), *Psydrax parviflora* (Afzel.) Bridson (Rubiaceae), *Premna quadrifolia* Schum. & Thonn. (Lamiaceae), *Cnestis corniculata* Schellenb. (Connaraceae). Lower Guinea species were, *Monanthotaxis parviflora* (Oliv.) Verdc. (Annonaceae), *Artabotrys dahomensis* Engl. & Diels. (Annonaceae), *Dalbergia lactea* Vatke (Fabaceae - Faboideae), *Ritchiea erecta* Hook. f. Syn. *R. pentaphylla* Gilg & Bened. (Capparaceae) and *Cercestis mirabilis* (N. E. Br.) Bogner Syn. *Rhektophyllum mirabile* (Araceae).

- Species richness estimations

The observed number of plant species for the EARF was 180. The species richness estimations as per Jack 1 and Jack 2 were 224.16 and 242.67 respectively. The Chao and Bootstrap estimators gave values of 217.62 and 200.52 respectively in species richness estimation.

The species accumulation curves show that they were hardly tending towards the asymptote (Figure 6). The species richness estimates differ strongly giving a range of 200.52–242.67 species, explaining that species accumulation curves are still climbing. This is unsurprising given that the sampling has not captured all the species in EARF. The shape of the species accumulation curves should plateau for large numbers of sites sampled.

FIGURE 2. Panoramic view of Ewe-Adakplame relict forest. A) Forest ecosystem in contact with dwellings; B) Forest gap with *Momordica charantia* carpet.

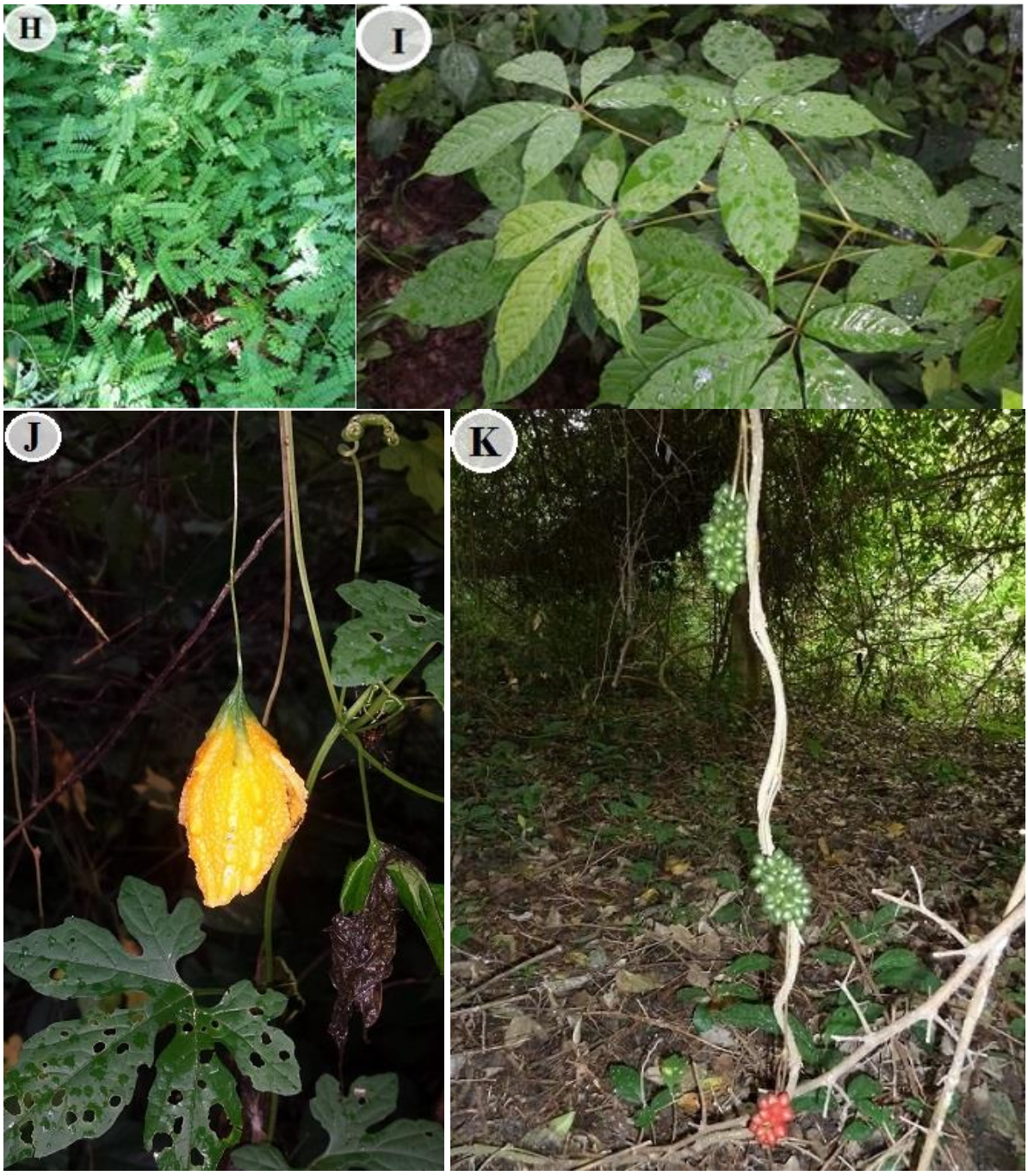

FIGURE 3. Common species to the Ewe-Adakplame relict forest. A) *Drypetes gilgiana*; B) *Triplochiton scleroxylon;* C) *Englerophytum oblanceolatum*; D) *Mansonia altissima*; E) *Uvariopsis tripetala;* F) *Ceiba pentandra;* G) *Anchomanes welwitschii*; H) *Abrus precatorius*; I) *Vitex micrantha*; J) *Momordica charantia* ; K) *Dioscoreophyllum cumminsii*.

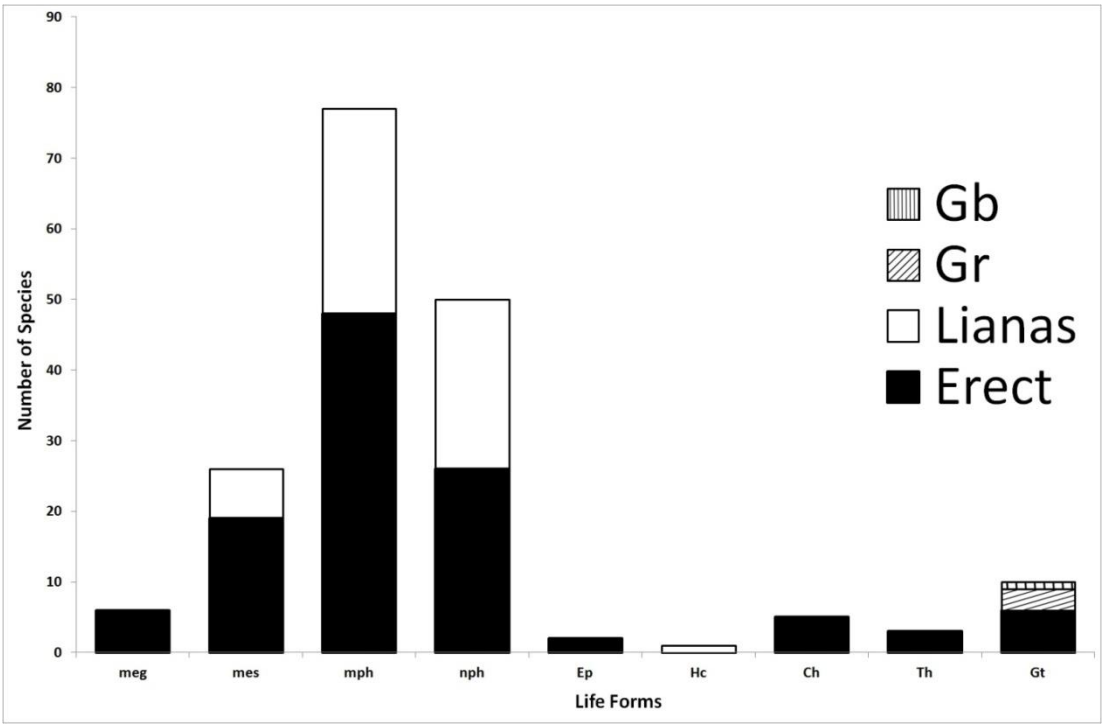

FIGURE 4. Life-form spectrum of the Ewe-Adakplame relict forest. Ph: Phanerophyte, G: Geophyte, Ch: Chamaephyte, Th: Therophyte, Ep: Epiphyte, Hc: Hemicryptophyte and climbing forms L: Liana (Lmph, Lnph and Lmes, LGr, LHc).

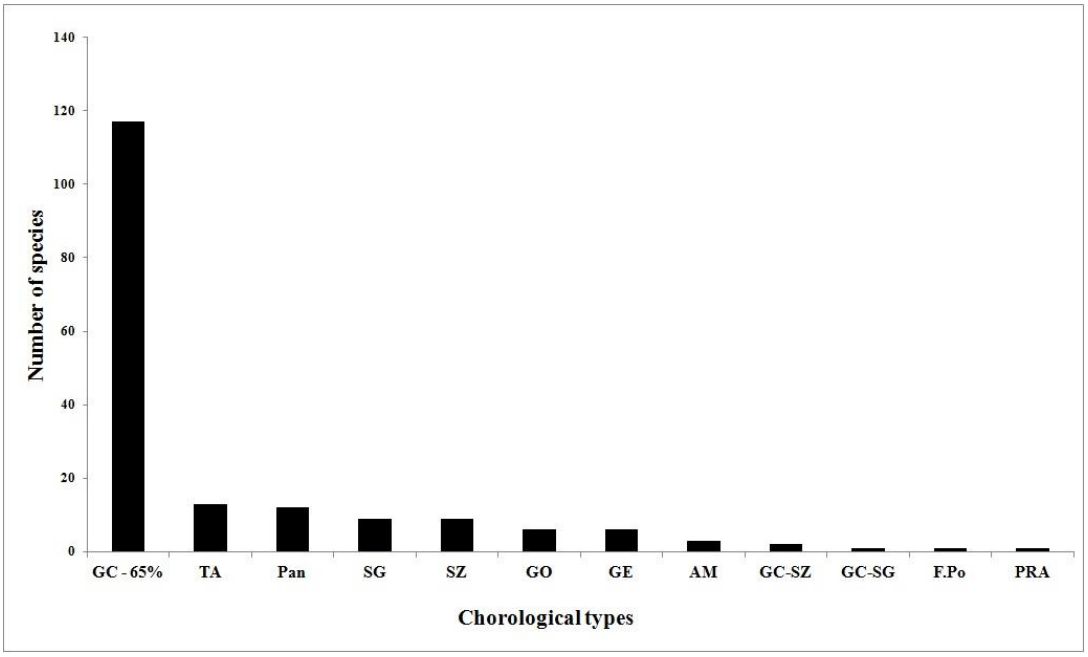

FIGURE 5. Chorological spectrum of the Ewe-Adakplame relict forest. GC: Guineo-Congolian, SG: Sudano/Guinean transition, SZ: Sudano-Zambezian, GE: Lower Guinean, GO: Upper Guinean, F. Po: Fernando Po islet, TA: Tropical Africa, PRA: Pluri Regional in Africa, AM: Afro-Malagasy and Pan: Pantropical.

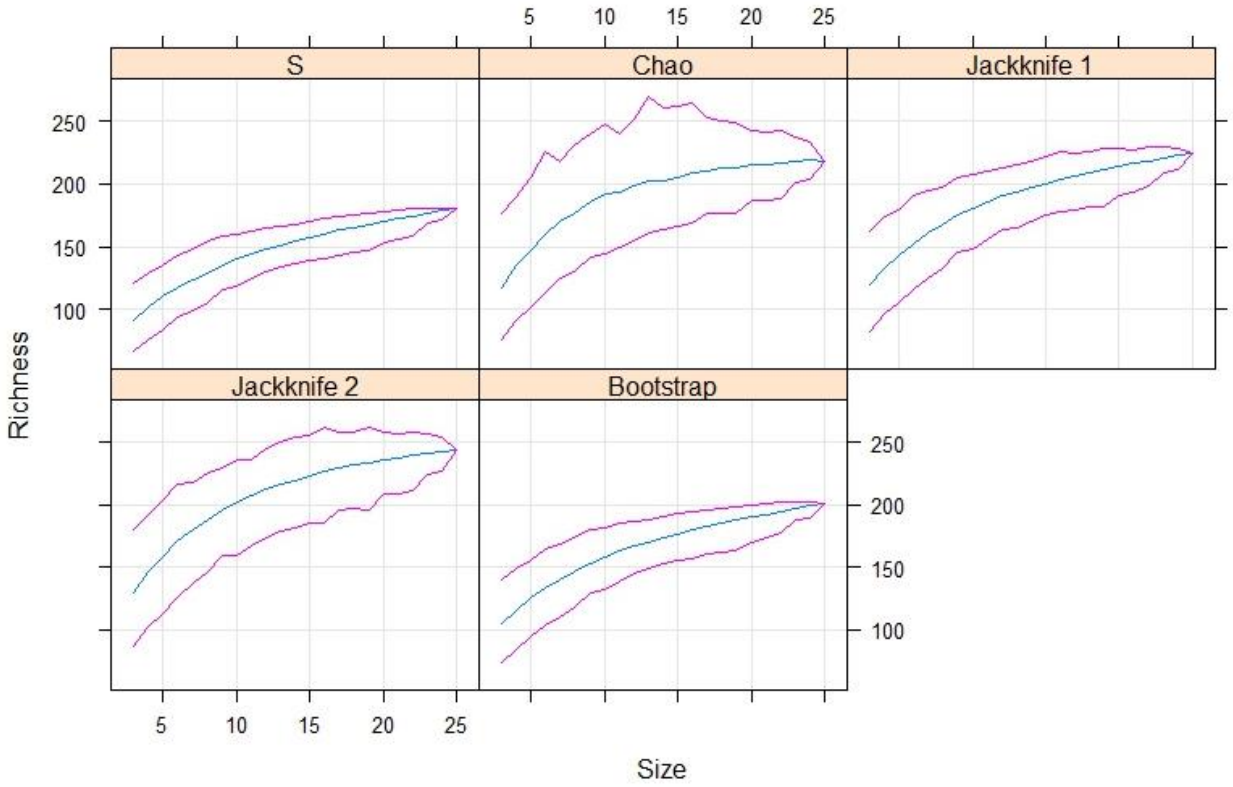

FIGURE 6. Species richness and richness estimations (Chao, first order jackknife, second order jackknife and bootstrap) (y-axis) in relation to sample size (x-axis) at the Ewe-Adakplame relict forest.

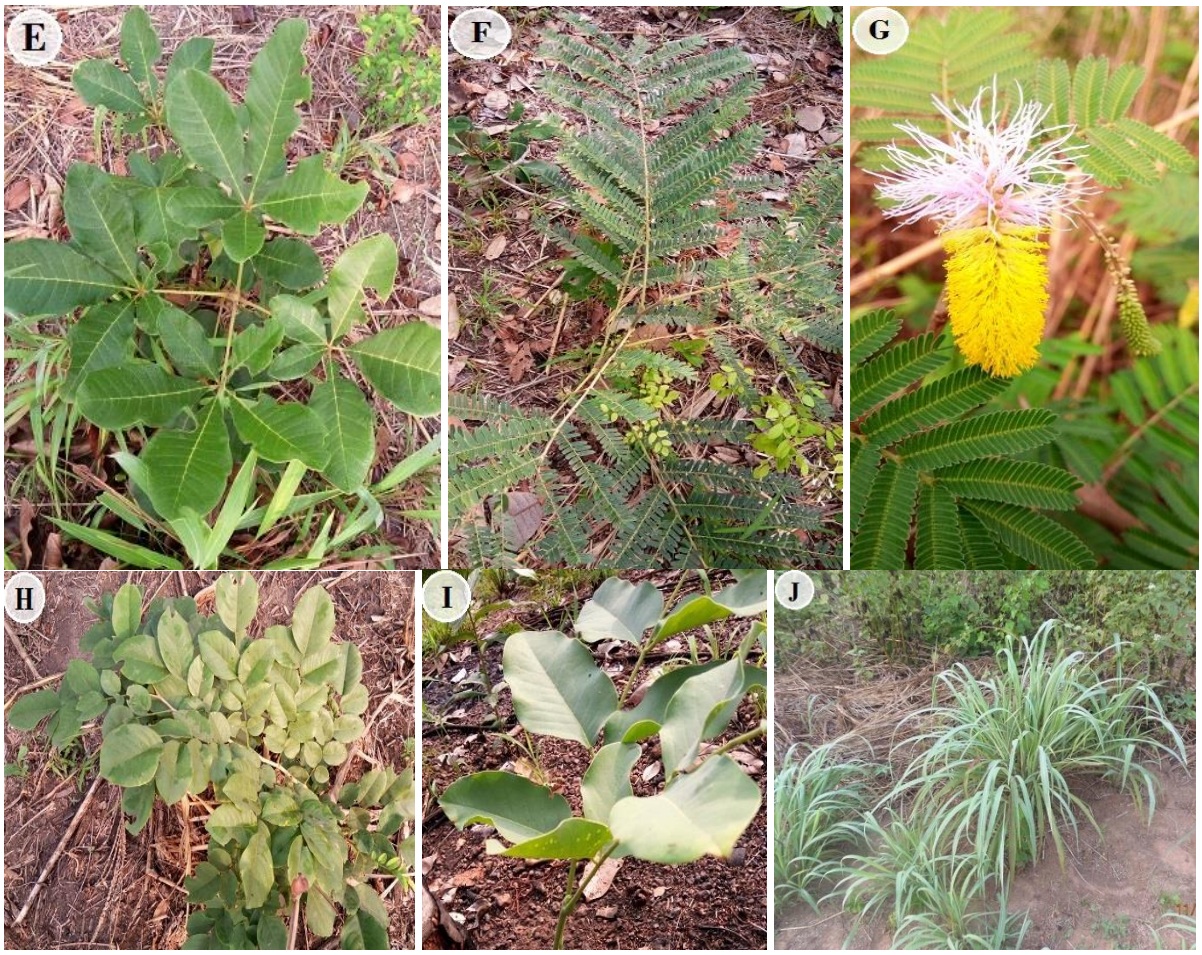

FIGURE 7. Species collected in the surrounding zone of Ewe-Adakplame relict forest. A) *Adansonia digitata;* B) *Pericopsis laxiflora*; C) *Trichilia emetica;* D) *Annona senegalensis*; E) *Vitex doniana*; F) *Parkia biglobosa*; G) *Dichrostachys cinerea*; H) *Pterocapus erinceus*; I) *Daniellia oliveri* and J) *Andropogon gayanus*.

FIGURE 8. Ewe-Adakplame relict forest in a matrix of savannah and agriculture landscape A) Forest edge affected by anthropogenic activities; B) Landscape of fallow and field around the edge of the forest ecosystem.

Discussion

The Ewe-Adakplame relict forest corresponds to the semi-deciduous forest, which was described in Benin as the *Drypetes aframensis-Nesogordonia papaverifera* community (Adomou et al., 2009). Guineo-Congolian species are abundant (65%) although the EARF is located in a matrix of savannah-dominated vegetation.

Guineo-Congolian species accounted for 33% in riparian forests of Benin (Natta, 2003), 61.7% in gallery forests of the Hippopotamus Pond Biosphere Reserve at Burkina Faso (Bélem and Guinko, 1998), and 70 to 75% in gallery forests at Lamto (southern Côte d'Ivoire) (Devineau, 1975). The overall plant species composition makes EARF floristically comparable to the moist semi-deciduous forest of Nigeria (Lower Guinea) (Richards, 1939) and the *Celtis* spp.-*Mansonia altissima* community of Côte d'Ivoire (Upper Guinea) (Guillaumet and Adjanohoun, 1971). Guillaumet and Adjanohoun (1971) also pointed out that the dominance of Cannabaceae (previously Ulmaceae) and Malvaceae (previously Sterculiaceae) in the Upper and Lower Guinea forests offers evidence that West African semi-deciduous forests are at climatic climax. These indicator families were also reported as characteristic of the semi-deciduous forests in Ghana (Vooren and Sayers, 1992) and Côte d'Ivoire (Swaine, 1996) within the Upper Guinea zone.

The connection of the floristic composition of EARF with the West African forest blocks located on both side of the Dahomey Gap is emphasized here by the high proportion of Guineo-Congolian species recorded (65%). The high contribution of Guineo-Congolian basin species substantiates the thesis that EARF is a remnant of dense or evergreen forests which were once a continuous block from west to central Africa (Maley, 2002; Tossou, 2002; Salzmann and Hoelzmann, 2005). The floristic link of the EARF to the West African semi-deciduous forest is best highlighted by the high representation of many Upper Guinean endemic species belonging to the families of Cannabaceae (*Celtis mildbraedii, C. zenkeri* and *C. prantlii*), Malvaceae (*Triplochiton scleroxylon*, *Nesogordonia papaverifera*, *Mansonia altissima*, *Pterygota macrophylla*, *Octobolus spectabilis* and *Sterculia tragacantha*), and Putranjivaceae (*Drypetes floribunda*, *D. gilgiana* and *D. aframensis*). This record provides strong evidence for past floristic connections with the West African rainforest zone. Furthermore, the richness of EARF in *Rinorea* species (*R. brachypetala*, *R. dentata*, *R. kibbiensis* and *R. ilicifolia*) and their abundance are unique in the country. *Rinorea* species are described as good indicators for West African semi-deciduous forests in a climax state (Achoundong, 2000). Adomou *et al.* (2009) reported that in Benin, *Rinorea* species appears to be restricted to EARF. The strong representation of *Rinorea* spp. and the dominance of Ulmaceae and Sterculiaceae substantiate the view of Guillaumet and Adjanohoun (1971), who considered this forest type as the climatic climax or primeval type of semi-deciduous forest in West Africa.

In contrast, the surrounding vegetation of EARF is composed of savannah species (Figure 7. A–J) from the Guineo-Sudanian transition zone such as: *Adansonia digitata* (Malvaceae), *Stereospermum kuntianum* (Bignoniaceae), *Trichilia emetica* (Meliaceae), *Annona senegalensis* (Annonaceae), *Vitex doniana* (Lamiaceae), *Parkia biglobosa* (Fabaceae-Mimosoideae), *Dichrostachys cinerea* (Fabaceae-Mimosoideae), *Pterocapus erinaceus* (Fabaceae-Faboideae), *Pericopsis laxiflora* (Fabaceae-Faboideae), *Daniellia oliveri* (Fabaceae-Ceasalpinoideae) and *Andropogon gayanus* (Poaceae). The landscape is characterized by two basin ecosystems with clear dissimilarity combining forest/savannah and crop areas in stable equilibrium. This makes EARF a special site of rich biodiversity and emphasizes the vital role the forest plays as a corridor of transition conducive to resilience and the flow of genes for ecosystem equilibrium.

The EARF is of great concern in Benin due to its floristic uniqueness and high level of threat. It provides habitat for priority species which are either nationally or globally

threatened or found only in this ecosystem. Thus, most of species remaining within the single location of EARF makes them vulnerable to outside threats especially to deforestation (Lawton, 1993). *Albizia ferruginea* (vulnerable), *Nesogordonia papaverifera* (vulnerable), *Mansonia altissima* (endangered) (IUCN 2016) and *Uvariopsis tripetala* (vulnerable, Hawthorne, 1998) are among globally threatened species restricted to EARF. It is important to emphasize that the EARF deserves urgent conservation needs in order to rescue its biological resources, especially many range-restricted species such as *Mansonia altissima* and *Nesogordonia papaverifera*. The population of *Mansonia altissima* is almost completely depleted, since it is locally used for roofing poles. *Englerophytum oblanceolatum* is among one of poorly known and neglected plant species of Sapotaceae which is probably restricted to EARF in Benin. Local populations questioned in 2014 at villages of Ewe and Adakplame reported that this native tree species of semi-deciduous forest can be used for making wine because of its sweet and tangy taste, similar to grapes (Houngnon, 2014). Chapman et al. (2002) and Sherrow and Amsler (2005) reported that *E. oblanceolatum* is a tree forest species providing folivorous biomass for non-human primates. However, as is the case with most of native species of EARF, *E. oblanceolatum* has been long ignored and poorly documented, while its conservation status is not yet assessed.

But in Benin, the status of relict forests is problematic. The Ewe-Adakplame relict forest is facing a continuous decline of its natural habitat as a consequence of expanding agriculture and encroaching human boundaries. Moreover, urbanization and land pressure as observed in the case of the "open field" structure in Ewe and Adakplame villages negatively impacts the vegetation of the EARF. Inevitably, the reliance of the population on the natural resources of the forest will lead to more severe fragmentation. Today, EARF appears as a metapopulation of rare species in a matrix of savannah and agriculture landscape (Figure 8. A–B). However, EARF has not yet gained attention from conservationists and the local human pressure continues to increase. In this case, the effectiveness of protection measures in this area is questionable; because in fact, the forest is still being under local communities control without any management plan.

Conclusion

This list of vascular plants reveals the uniqueness of Ewe-Adakplame Relict Forest in Benin. This justifies its particularity and the need to examine the best strategies for the conservation of this forest relict. We hope this baseline vegetation information will lead towards the gazetting of EARF to conserve the rich flora, habitats and the whole biodiversity therein. Particularly, the management of forest of this type, raises the question of deepening interactions linking it to human activities since millennia. In perspective, it would be interesting to understand these interplay between locals and the forest to explain the persistence of EARF in this savannah dominated landscape. Therefore, the actions to be considered for the conservation of EARF must take into account the community engagement in order to ensure the multi-functionality of the community lands harbouring the forest relic.

Table II. Vascular plants of the Ewe-Adapklame relict forest in Benin with their binomial, family life-forms and Chorotypes [Life-forms are meg: megaphanerophyte (> 30 m tall), mes: mesophanerophyte (8-30 m), mph: microphanerophyte (2-8 m), nph: nanophanerophyte (0.5-2 m); Ch: chamaephyte, Hc: hemicryptophyte; Th:

therophyte; G: geophyte (Gb: with bulb, Gr: with rhizome and Gt: with tuber); Ep: epiphyte and their climbing forms L: liana (Lmph, Lnph and Lmes, LGr, LHc) and chorotypes are GC: Guineo-Congolian, SG: Sudano/Guinean transition, SZ: Sudano-Zambezian, GE: Lower Guinean, GO: Upper Guinean, F. Po: Fernando Po islet, TA: Tropical Africa, PRA: Pluri Regional in Africa, AM: Afro-Malagasy and Pan: Pantropical].

SCIENTIFIC NAME	**LIFE FORM**	**CHOROLOGICAL TYPES**
Acanthaceae		
Rhinacanthus virens (Nees) Milne. Readh. var. *virens*	Ch	GC
Amaranthaceae		
Cyathula prostrata (L.) Blume	Th	Pan
Amaryllidaceae		
Scadoxus multiflorus (Martyn) Raf. subsp *multiflorus*	Gb	TA
Anacardiaceae		
Lannea nigritana (Sc. Elliot) Keay var. *nigritana*	mes	GO
Spondias mombin L.	mes	Pan
Annonaceae		
Artabotrys dahomensis Engl. & Diels.	Lnph	GE
Artabotrys velutinus Sc. Elliot	Lnph	GC
Monanthotaxis parvifolia (Oliv.) Verdc.	Lnph	GE
Monodora tenuifolia Benth.	mph	GC
Uvariodendron angustifolium (Engl. & Diels) R.E.Fr	mph	GC
Uvariopsis tripetala Bak. f. Syn. *Dennettia tripetala*	mph	GE
Xylopia longipetala De Wild. & T. Durand	mph	GC
Apocynaceae		
Alafia barteri Oliv.	Lmph	GC
Ancylobothrys scandens (Schumach. & Thonn.) Pichon	Lmph	GC
Baissea zygodioides (K. Schum.) Stapf	Lmph	GC
Gongronema angolense (N. E. Br.) Bull.	Lmph	TA
Holarrhena floribunda (G. Don) Dur. & Schinz	mph	TA
Hunteria umbellata (K. Schum.) Hall. f. Syn. *H. eburnea Pichon*	mph	GC
Landolphia hirsuta (Hua) Pichon	Lmes	GC
Mondia whitei (Hook. f.)	Lmph	TA
Motandra guineensis (Thonn.) A. DC.	Lmph	TA
Periploca nigrescens Afzel. Syn. *Parquetina nigrescens*	Lmph	GC
Saba thompsonii (A. Chev.) Pichon	Lmes	GC
Secamone afzelii (Schultes) K. Schum.	Lmph	GC
Araceae		
Anchomanes difformis (Blume) Engl. (Syn. *Anchomanes welwitschii* Rendle)	Gt	GC
Cercestis mirabilis (N. E. Br.) Bogner Syn. *Rhektophyllum mirabile*	Ep	GE
Aristolochiaceae		
Pararistolochia goldieana (Hook. f.) Hutch. & Dalz.	LGr	GC
Asparagaceae		
Dracaena arborea Bak	mph	GC
Asteraceae		

SCIENTIFIC NAME	LIFE FORM	CHOROLOGICAL TYPES
Chromolaena odorata (L.) R. King & H. Robinson	nph	AM
Gymnanthemum coloratum (Willd.) H.Rob. & B.Kahn	mph	SZ
Laggera crispata (Vahl) Hepper & J. R. I. Wood.	Th	TA
Bignoniaceae		
Newbouldia laevis (P. Beauv.) Seem. ex Bureau	mph	GC
Boraginaceae		
Ehretia cymosa Thonn.	mph	GC
Cannabaceae		
Celtis mildbraedii Engl.	mes	GC
Celtis philippensis Blanco Syn. *C. brownii*	mph	GC
Celtis zenkeri Engl.	meg	GC
Trema orientalis Syn. *T. guineensis*	mph	GC
Capparaceae		
Capparis brassii DC. Syn. *C. thonningii* Schum.	Lnph	GC
Capparis erythrocarpos Isert var. *erythrocarpos*	nph	GC
Maerua duchesnei (De Wild.) F. White Syn: *Ritcheia duchesnei*	mph	GC
Ritchiea capparioides (Andr.) Britten var. *capparoides*	Lnph	GC
Ritchiea erecta Hook. f. Syn. *R. pentaphylla* Gilg & Bened.	nph	GE
Celastraceae		
Loeseneriella africana Willd. var. africana Syn. *Hippocratea africana*	Lmph	Pan
Reissantia indica (Willd.) N. Hallé	Lnph	Pan
Salacia longipes (Oliv.) N. Hallé	nph	TA
Salacia pallescens Oliv.	nph	GC
Simicratea welwitschii (Oliv.) N. Hallé Syn. *Simirestis welwitschii* (Oliv.) N.Hallé	Lmph	GC
Combretaceae		
Combretum racemosum P. Beauv.	Lmph	GC
Commelinaceae		
Cyanotis lanata Benth.	Ch	SG
Connaraceae		
Cnestis ferruginea Vahl ex DC.	nph	GC
Cnestis corniculata Lam. Syn. *Cnestis longiflora* Schellenb.	Lmph	GO
Rourea coccinea (Bak.) Jongkind syn. *Byrsocarpus coccineus* Thonn. & Schumach.	nph	TA
Convolvulaceae		
Calycobolus africanus (G. Don) heine	Lnph	GC
Ipomoea mauritiana Hall. f.	Lmph	Pan
Cucurbitaceae		
Coccinia grandis (L.) Voigt	Lnph	GC-SZ
Lagenaria breviflora (Benth.) Roberty Syn. *Adenopus breviflorus*	Lmes	TA
Luffa cylindrica (L.) M. J. Roem syn. *Luffa aegyptiaca* Mill	Lnph	Pan
Momordica charantia L.	Lnph	GC
Dichapetalaceae		
Dichapetalum madagascariense Poir. Syn. *D guineense* (DC.) Keay	Lmph	GC

SCIENTIFIC NAME	LIFE FORM	CHOROLOGICAL TYPES
Tapura fischeri Engl.	mph	GC
Dioscoreaceae		
Dioscorea bulbifera L. var. bulbifera	Gt	Pan
Dioscorea lecardii De Wild.	Gt	SZ
Dioscorea odoratissima Pax Syn. *D. praehensilis sensu* F.T.A, F.W.T.A	Gt	SG
Dioscorea quartiniana A. Rich.	Gt	SZ
Dioscorea sagittifolia Pax syn. *D. abyssinica* Hochst. ex Kunth	Gt	SZ
Ebenaceae		
Diospyros abyssinica (Hiern) White	mes	GC
Diospyros monbuttensis Gürke	mph	GC
Diospyros soubreana F. White	nph	GC
Euphorbiaceae		
Erythrococca anomala (Juss. ex Poir.) Prain	nph	GC
Mallotus oppositifolius (Geisel.) Müell. Arg. var. *oppositifolius*	nph	AM
Tragia senegalensis Müll. Arg.	Lnph	SG
Fabaceae		
Caesalpinoideae		
Detarium senegalense J.F. Gmel.	mes	GC
Dialium guineense Willd.	mes	GC
Mezoneuron benthamianum (Baill.) Herend. & Zarucchi	Lmph	GC
Faboideae/Papilioloideae		
Abrus precatorius L.	Lnph	Pan
Dalbergia lactea Vatke	Lmph	GE
Dalbergia melanoxylon Guill. Perr.	mph	SG
Desmodium salicifolium (Poir.) DC. var. *salicifolium*	nph	GC
Dolichos trilobus	Lnph	SZ
Millettia thonningii (Schum. & Thonn.) Bak.	mph	GC
Mimosoideae		
Acacia pennata (L.) Willd.	Lmph	TA
Acacia polyacantha Willd. subsp. *Campylacantha* (Hochst. ex A. Rich.) Brenan	mes	SZ
Albizia adianthifolia (Schum.) W. Wight var. *adianthifolia*	mes	GC
Albizia glaberrima (Schum. & Thonn.) Benth.	mph	GC
Albizia ferruginea (Guill. & Perr.) Benth.	mes	GC
Albizia zygia (DC.) J. F. Macbr.	mes	GC
Icacinaceae		
Stachyanthus occidentalis (Keay & Miège) Boutique syn. *Neostachyanthus occidentalis* Keay & Miège	Lnph	GO
Lamiaceae		
Clerodendrum capitatum (Willd.) Schum. & Thonn.	Lmph	GC
Hoslundia opposita Vahl	nph	AM
Premna quadrifolia Schum. & Thonn.	nph	GO
Vitex micrantha Gürke	mes	GC
Linaceae		
Hugonia platysepala Welw. ex Oliv.	Lmph	GC
Loganiaceae		

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Strychnos barteri Soler.	Lmes	GC
Strychnos floribunda Gilg	Lmes	GC
Strychnos nigritana Bak.	Lmes	GC
Strychnos splendens Gilg	Lmes	GC
Malvaceae		
Abutilon mauritianum (Jacq.) Medic.	Ch	TA
Ceiba pentandra (L.) Gaertn.	meg	Pan
Hibiscus lunariifolius Willd.	Lmph	Pan
Hibiscus owariensis P. Beauv.	np	GC
Cola millenii K. Schum.	mph	GC
Glyphaea brevis (Spreng.) Monachino	mph	GC
Grewia carpinifolia Juss.	mph	GC
Mansonia altissima (A. Chev.) A. Chev. var. *altissima*	mes	GC
Nesogordonia papaverifera (A. Chev.) syn *N. kabengaensis* (K.Schum.)	mph	GC
Octolobus spectabilis Welw. Syn. *O. angustatus* Hutch.	nph	GC
Pterygota macrocarpa K. Schum.	mph	GC
Sterculia tragacantha Lindl.	mes	GC
Triplochiton scleroxylon K. Schum.	meg	GC
Melastomataceae		
Memecylon afzelii G. Don var. afzelii	Lnph	GC
Warneckea memecyloides (Benth.) Jac. Fél Syn. *Memecylon memecyloides* (Benth)	Lmph	GC
Meliaceae		
Trichilia prieureana A. Juss. subsp. *prieureana*	mph	GC
Menispermaceae		
Dioscoreophyllum cumminsii (Stapf) Diels	Lnph	GC
Rhigiocarya racemifera Miers	Lnph	GC
Tiliacora funifera (Miers) Oliv.	Lmph	GC
Triclisia subcordata Oliv.	Lnph	GC
Moraceae		
Antiaris toxicaria Lesch. Syn : *A. africana*	meg	GC
Ficus goliath A. Chev.	mes	GC
Ficus ovata Vahl,	Ep	GC
Milicia exelsa (Welw.) Berg Syn. *Chlorophora excelsa* (Welw.) benth.	meg	GC
Olacaceae		
Olax subscorpioidea Oliv. var. subscorpioidea	mph	GC
Oleaceae		
Schrebera arborea A. Chev.	mes	GC
Opiliaceae		
Opilia amentacea Roxb. Syn. *O. celtidifolia* (Guill. & Perr) Endl.,	Lmph	SZ
Pandaceae		
Microdesmis keayana J. Léonard, syn. *Microdesmis puberula* Hook. f.	mph	GC
Passifloraceae		
Adenia cynanchifolia (Benth.) Harms	Lmph	F.Po

SCIENTIFIC NAME	LIFE FORM	CHOROLOGICAL TYPES
Adenia lobata (Jacq.) Engl.	Lmph	GC
Phytolaccaceae		
Hilleria latifolia (Lam.) H. Walt.	Ch	AM
Poaceae		
Acroceras gabunense (Hack.) Clayton	Th	GC
Olyra latifolia L.	nph	GC
Oplismenus hirtellus (L.) P. Beauv. subsp. *Hirtellus*	Ch	SG
Streptogyna crinita P. Beauv.	Gr	GC
Polygalaceae		
Carpolobia lutea G. Don	mph	GC
Putranjivaceae		
Drypetes aframensis Hutch.	mph	GO
Drypetes floribunda (Müll. Arg.) Hutch.	mph	GC
Drypetes gilgiana (Pax) Pax & Hoffm.	nph	GC
Rhamnaceae		
Lasiodiscus mannii Hook. f.	mph	GC
Rubiaceae		
Aidia genipiflora (DC.) Dandy	mph	GC
Chassalia kolly (Schumach.) Hepper	nph	GC
Coffea ebracteolata (Hiern) Brenan	Lnph	GC
Cremaspora triflora (Thonn.) K. Schum.	Lmph	GC-SZ
Dictyandra involucrata Hook. f.	Lnph	GC
Gardenia nitida Hook.	mph	GC
Hymenodicton pachyantha	mes	GC
Keetia hispida (Benth.) Bridson	Lmph	GC
Morinda lucida Benth.	mph	Pan
Oxyanthus pallidus Hiern	nph	GC
Oxyanthus racemosus (Schum. & Thonn.) Keay	nph	GC
Pavetta corymbosa (DC.) F. N. Williams	mph	SG
Pouchetia africana DC.	nph	GC-SG
Psydrax horizontalis (K. Schum. & Thonn.) Bridson	Lmph	SG
Psydrax parviflora (Afzel.) Bridson	nph	GO
Rothamannia longiflora Salisb	mph	GC
Rothamannia urcelliformis (Hiern) Robyns	mph	GC
Rytigynia canthioides (Benth.) Robyns	mph	GC
Vangueriella nigerica (Robyns) Verdc. Syn. *Vangueriopsis nigerica*	mph	SZ
Vangueriella spinosa (Schumach.&Thonn.)Verdc. Syn. *Vangueriopsis spinosa* Hepper	mph	SZ
Rutaceae		
Zanthoxylum leprieurii Guill. & Perr. Syn. *Fagara angolensis* Engl.	mph	GC
Zanthoxylum rubescens	mPh	GC
Zanthoxylum zanthoxyloides (Lam.) Zepernick & Timber	mph	SG
Salicaceae		
Flacourtia indica (Burm. f.) Merr. Syn. *Flacourtia flavescens* Willd.	mph	GC
Sapindaceae		

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Allophylus africanus P. Beauv.	mph	GC
Allophylus spicatus (Poir.) Radlk.	mph	GC
Blighia sapida Koenig	mPh	Pan
Blighia unijugata Bak.	mph	GC
Deinbollia pinnata (Poir.) Schumach. & Thonn.	nph	GC
Lecaniodiscus cupanioides Planch.	mph	GC
Majidea forsteri (Sprague) Radlk.	meg	GC
Pancovia bijuga Willd.	mph	GC
Sapotaceae		
Englerophytum oblanceolatum syn. *Bequaertiodendron oblanceolatum*	nph	TA
Pouteria alnifolia (Baker) Roberty Syn. *Malacantha alnifolia* (Baker)	mph	GC
Smilacaceae		
Smilax anceps Willd.Syn. *S. kraussiana* Meissner	LGr	TA
Solanaceae		
Solanum terminale Forssk. Subsp inconstans (C.H. Wright) Heine	Lmph	GC
Ulmaceae		
Chaetachme aristata Planch.	mph	GC
Violaceae		
Rinorea brachypetala (Turcz.) Kuntze	nph	GC
Rinorea ilicifolia (Welw. ex Oliv.) Kuntze	nph	GC
Rinorea kibbiensis Chipp.	nph	GC
Vitaceae		
Cissus glaucophylla Hook.	Lnph	GC
Cissus petiolata Hook. f.	Lnph	GC
Cissus populnea Guill. & Perr. var. *populnea*	LHc	SZ
Cissus quadrangularis L.	Lmph	SZ

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