American Journal of Agriculture and Forestry
2021; 9(6): 334-341
http://www.sciencepublishinggroup.com/j/ajaf
doi: 10.11648/j.ajaf.20210906.11
ISSN: 2330-8583 (Print); ISSN: 2330-8591 (Online)

Biophysical Characterisation of Baobab Parks in Middle and Upper Casamance in Southern Senegal

Tamsir Mbaye[1], Ababacar Ndiaye[2], Marième Fall Ba[1], Dioumacor Fall[1], Daouda Ngom[3]

[1]National Centre for Forestry Research of the Senegalese Institute for Agricultural Research, Dakar, Senegal

[2]Agroforestry Department, Assane Seck University, Ziguinchor, Senegal

[3]Plant Biology Department, Cheikh Anta Diop University, Dakar, Senegal

Email address:
tamsirmbaye76@gmail.com (T. Mbaye), ababacar85ndiaye@gmail.com (A. Ndiaye), bfma09@yahoo.fr (M.F. Ba), dioumacorfall@yahoo.fr (D. Fall), ngom_daouda@yahoo.fr (D. Ngom)

To cite this article:
Tamsir Mbaye, Ababacar Ndiaye, Marième Fall Ba, Dioumacor Fall, Daouda Ngom. Biophysical Characterisation of Baobab Parks in Middle and Upper Casamance in Southern Senegal. *American Journal of Agriculture and Forestry*. Vol. 9, No. 6, 2021, pp. 334-341. doi: 10.11648/j.ajaf.20210906.11

Received: October 4, 2021; **Accepted**: October 22, 2021; **Published**: November 5, 2021

Abstract: In the middle and upper Casamance, the products of the baobab tree (*Adansonia digitata* L.) make an important contribution to the lives of the population. However, information on the status of baobab populations in this area is insufficient. The aim of this study is to characterise the baobab parks in this area from a biophysical point of view. To do this, the sample involved 756 baobab trees, 89 of which were in hut parks, 223 in villages and 444 in the bush. The parameters assessed on each baobab tree were circumference at 1.3m, total height, crown diameter, number of primary branches, distance between individuals, level of fruiting and signs of anthropisation. The data were subjected to an analysis of variance with the ANOVA test followed by the Student Newman Keuls test at the 05% threshold. The results showed a significant difference (Pvalue <0.05) between parks for each parameter except circumference at 1.3m. The village parks had the highest values for circumference at 1.3m (5.27±2.12m), for crown diameter (14.06±6.62m) and for distance between baobabs (19.12±8m). On the other hand, the tallest baobabs (37.79±8.93m) with the highest number of primary branches (22±14) are observed in the bush parks. According to the structural analysis, the majority of the parks (<50%) have large baobabs. The hut and village parks are dominated by the height and diameter classes of [25-35] m and [5-10] m respectively. On the other hand, in the bush parks, the most represented baobabs are found in the height <35m and diameter [1-5] m classes. Furthermore, the results on fruiting showed that bush parks have more baobabs with a high level of fruiting. Also, concerning anthropisation, high rates (more than 52% of baobabs) were noted for each type of park. These results show an ageing baobab population threatened by strong anthropic pressure. Thus, efforts should be made to ensure the survival of these baobab populations, which are essential to the life of local populations, through better management.

Keywords: Park Types, Characterisation, Anthropisation, Fruiting, Management, Middle and Upper Casamance

1. Introduction

A lot of studies have highlighted the multiple and fundamental roles that wild plants, particularly woody species, play in the diet of populations, especially small-scale producers in sub-Saharan Africa [1-3]. The inclusion of these woody species in farmers' production systems reduces the risks inherent in agriculture [4]. These traditional land-use systems are known as 'agroforestry parks' [5]. Agroforestry parks are most often characterised by the dominance of one or more species. The baobab, *Adansonia digitata* L., is one of the main local multipurpose woody species in traditional agroforestry parks in Sahelian countries [5-7]. It is also one of the dominant species in West African agroforestry systems [8]. The baobab leaf is an excellent source of protein and contains all essential amino acids, as well as most non-essential amino acids. It is also high in minerals and vitamins A and C [9]. The baobab also provides fibre (bark) used to make ropes, fodder for livestock (leaves) and medicinal products obtained from different parts of the tree and used to treat various diseases [9]. The tree is also recognised as an important source of income, hence the special attention given to these products, especially the fruit, in national, sub-regional and international trade [10]. In addition, the approval of the sale of baobab fruit pulp by the European Union (EU) and the United States of America (USA) has allowed formal access to the international market and offers opportunities for income generation for millions of people [11]. This renewed interest around baobab pulp explains the profusion of functional groups in Senegal, especially in the Regions of Kédougou, Tambacounda and Kolda, that are active around baobab resources [12].

Because of its growing importance, the baobab is among the species that are most exploited to satisfy the demand of urban centres and exports. Unfortunately, this exploitation is done with often inappropriate methods with the sole aim of satisfying the growing market demand. In 2013, at the beginning of this study, *Adansonia digitata* L. parks are threatened and are also in a state of degradation or even ageing [13, 9]. Thus, this study aims to characterise the state of baobab populations in the Middle and Upper Casamance of Senegal in order to better understand their evolution and to propose sustainable management solutions. The study was conducted at the end of 2013 in the natural regions of Middle and Upper Casamance, specifically in the administrative regions of Kolda (municipalities of Saré bidji and Ndorna) and Sédhiou (municipalities of Sakar and Bogal) (Figure 1).

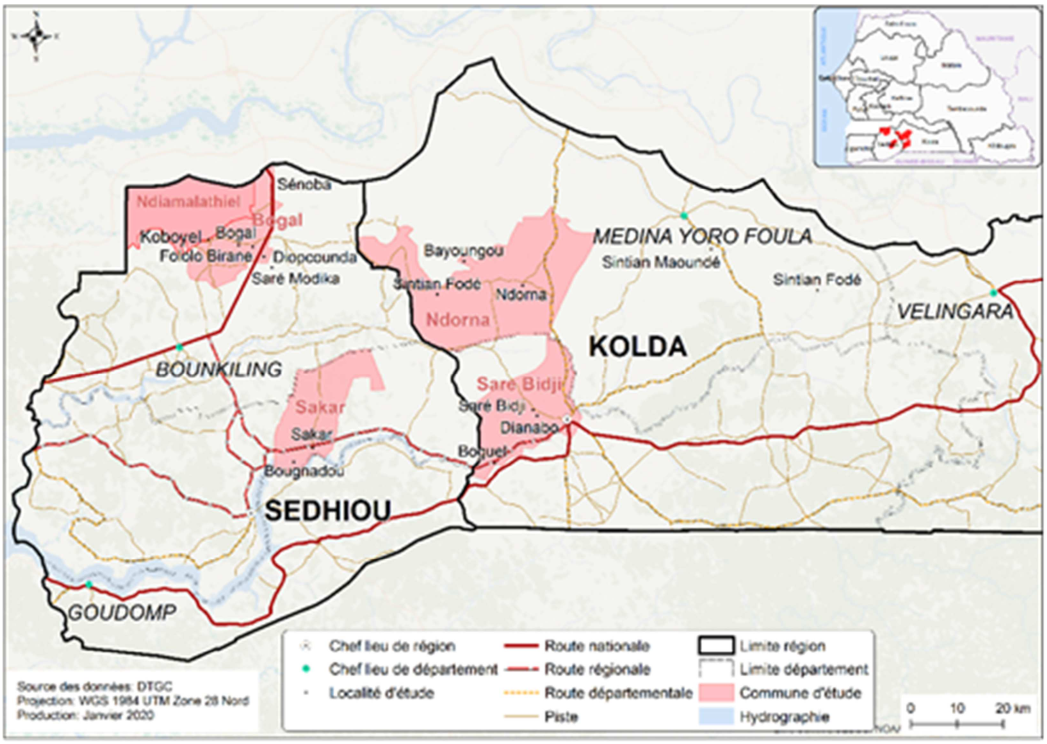

Figure 1. *Location of the study sites.*

2. Methods

2.1. Survey and Pre-inventory

This phase consisted of locating the baobab parks and observing their different characteristics (Table 1). It allowed us to know the spatial distribution of the parks and their typology. This facilitated the choice of sites for this study. During this phase, surveys were carried out among rural populations, officials of the IREFs of Kolda and Sédhiou, and the municipal councils of the four targeted communes (two per region). All the parks selected were visited, mapped and characterised. The characterisation involved a visual assessment of the density (low, medium or high) and the type of park (hut, village or bush) in relation to the fields through direct observations in the field. Indeed, the hut fields refer to the space adjacent to the huts and which frequently receives organic manure and household waste. The village fields follow the hut fields, while the bush fields refer to those far from the village.

2.2. Sampling

The choice of parks was motivated by the existence of a high potential according to the size of the parks and the density of baobabs. Thus, the parks inventoried according to their topology are distributed according to regions, communes and villages. There are 4 hut parks with a total of 89 feet, 7 village parks with a total of 223 feet and 8 bush parks with a total of 444 feet (Table 1). Specifically by Commune and by type of park, we have for the hut parks (PC): 3 in Saré Bidji with 89 individuals spread over 5 ha, 1 in Bogal with 24 individuals spread over 1 ha. For the village parks (PV), we have 3 in Saré Bidji with 99 individuals spread over 9 ha, 3 in Ndorna with 124 individuals spread over 8 ha, 1 in Sakar with 34 individuals spread over 4 ha. For the bush parks (BP), we have 1 in Ndorna with 36 individuals spread over 2 ha, 3 in Sakar with 184 individuals spread over 7 ha and 4 in Bogal with 166 individuals spread over 11 ha.

Table 1. Location and type of park.

Region	Municipality	Village	Type of park
		Marakissa Tobel	Case
		Tandioufa	Case
		Dianabo	Case
	SARE BIDJI	Boguel	Village
		Tabassaye Yéro	Village
KOLDA		Sinthian Thierno Noumou	Village
		Bayoungou	Village
	NDORNA	Yaou ndar Maoundé	Village
		Sinthian Aliou	Village
		Goumbantang	Brousse
		Bougnadou	Village + Bush
	SAKAR	Sinthian Fodé	Bush
		Sinthian Maoundé	Bush
SEDHIOU		Diopcounda	Bush
	BOGAL	Fololo Birane	Bush
		Saré ModiKa	Bush
		Sénoba	Bush + Case

2.3. Parameters Assessed

Depending on the size of the park, one to four one-hectare plots were surveyed. The plot is a 100 m square and its installation was marked with stakes. The straightness of each side is determined by sighting from the first stake in order to adjust the last one. The angles were obtained by the triangular method (3, 4, 5 i.e. adjacent side = 4 m, opposite side = 3 m and hypotenuse = 5 m).

In each plot, all baobab trees were counted. Also, at the level of each individual, various parameters were measured and recorded. These are the circumference at 1.30 m, the diameters of the crown in two directions (East-West and North-South), the total height, the number of tiers (different levels of insertion of the primary branches on the stem) and the distance between baobabs (distance to the nearest individual). Qualitative data were also taken, including the assessment of the levels (absence, low, medium and high) of fruiting on each baobab and anthropogenic signs (pruning and/or trimming, debarking, death on the ground and others). Other information was noted in the plots, including the type of park (hut, village or bush) and disturbances (passage of fire, traces of grazing, crops, etc.).

3. Main Characteristics of the Parks Studied

3.1. Morphological Characteristics of Baobabs According to Park Typology

3.1.1. Circumference at 1.3 m of the Tree

Between the different types of baobab parks[1], the analysis of variance of the circumferences at 1.30 m shows no significant difference (P value=0.051). The results indicate that the circumference at 1.30 m is higher in the bush parks with the lowest and highest values (Figure 2).

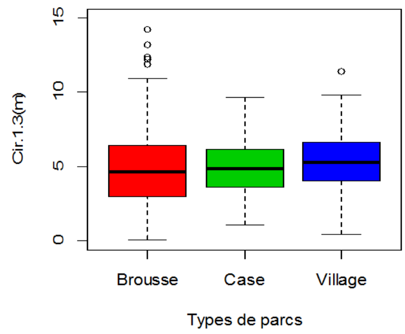

Figure 2. Comparison of circumferences at 1.3 m between park types.

3.1.2. Tree Crown Diameter

According to the analysis of variance, the difference in mean crown diameter between park types is significant (P value=0.010). It shows two groups, 'a' for the bush and village parks which have the highest median value and 'b' for the hut park (Figure 3).

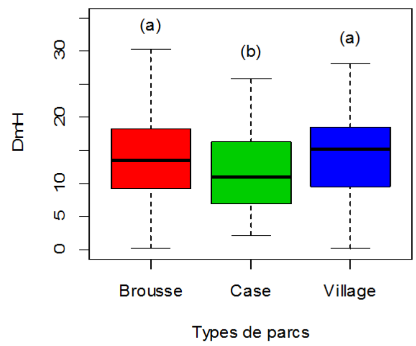

Figure 3. Comparison of average crown diameters between park types.

3.1.3. Total Tree Height

The results of the analysis of variance show a significant difference (P value= < 2.2e-16) in total height between park types (Figure 4). The height of the individuals is significantly higher in the bush parks compared to the hut and village parks.

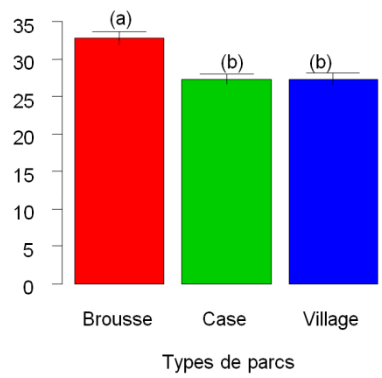

Figure 4. Comparison of average total heights between park types.

3.1.4. Comparison of the Average Number of Landings Between Park Types

According to the analysis of variance, the difference in the

1 Brousse = bush; case = case; village = village

average number of landings is significant (P value=2.393e-15) between, on the one hand, the bush park with the highest number of landings (group 'a') and, on the other hand, the hut and village parks which are in group 'b' with the lowest values (Figure 5).

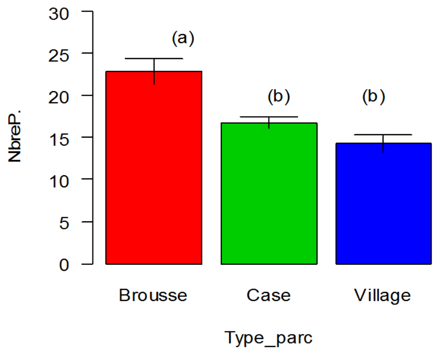

Figure 5. *Comparison of the average number of landings between park types.*

3.1.5. Average Distance Between Trees

Concerning the average distance between trees, there is a significant difference (P value=9.009e-06) between the parks (Figure 6). The village park has the highest values, group 'a', compared to the hut and bush parks, group 'b'.

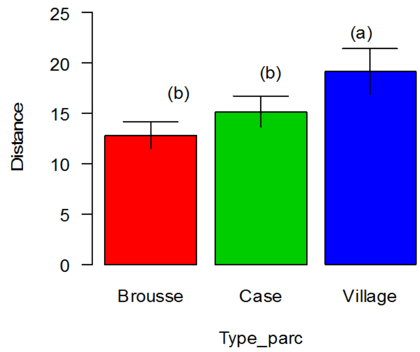

Figure 6. *Comparison of the average distance between trees according to park types.*

Table 2. *Summary of the different dendrometric characteristics of baobab park types.*

Type of park	Circumference 1,3 (m)	Tree crown diametre (m)	Total height (m)	Nomber of bearings	Distance between trees (m)
Casse	4.95±1,74 a	11.63± 5,52 b	27.28± 6,37 b	16± 6 b	15.11 ± 14,52 b
Village	5.27± 2,12 a	14.06± 6,62 a	27.33 ± 7,57 b	14 ± 9 b	19.12± 21,79 a
Bush	4.81 ±2,48 a	13.46± 6,48 a	32.79 ± 8,93 a	22 ± 14 a	12.80 ± 12,12 b
Pr (>F)	0.05115.	0.01096 *	< 2.2e-16 ***	2.393e-15 ***	9.009e-06 ***

According to Table 2, the village park where baobabs are more distant from each other also has the largest circumferences at 1.3 m and the largest crown diameters. The tallest trees with the highest number of bearings are observed in the bush park. The hut park has the smallest crown diameters.

Figure 7. *Level of fruiting of baobabs in parks.*

Table 3. *Correlation matrix of different dendrometric characteristics.*

	Cir. 1.3	HT	Dm Hp	Distance	Bearings
Cir. 1.3	1.00	0.51	0.82	0.18	0.44
HT	0.51	1.00	0.60	-0.01	0.37
Dm Hp	0.82	0.60	1.00	0.18	0.43
Distance	0.18	-0.01	0.18	1.00	0.16
Bearings	0.44	0.37	0.43	0.16	1.00

According to the results of the correlation matrix table 3, circumference at 1.3 m and DmHp are strongly related (r=0.82). The correlation between the other parameters is weak.

3.2. Fructification According to Park Typology

Figure 7[2] shows that the frequency of fruiting baobabs is very high (more than 75%) with levels varying from one park to another. This frequency of fruiting baobabs is low for all of the hut parks (80.9%) and for the majority of the village parks (40.3%). On the other hand, this level of fruiting is high in the bush parks for the majority (50.5%).

2 Fort = high; moyen = medium; faible = low;

3.3. Anthropogenic Pressure According to Park Typology

According to figure 8, anthropic pressure decreases from hut parks (57.3%) to bush parks (52.3%) and village parks (55.2%). Depending on the type, the dominant anthropisation is debarking in the hut parks (31.5%) and bush parks (39.6%) and pruning in the village parks (29.6%).

Figure 8. *Types of anthropisation in baobab parks.*

3.4. Structure of the Baobab Population According to Park Typology

3.4.1. Structure by Height Classes

According to the structure of the baobab population according to height (Figure 9), the class [25-35m] groups together the highest frequency of baobabs in the hut and village parks. On the other hand, in the bush park, the highest frequency is observed in class 35>.

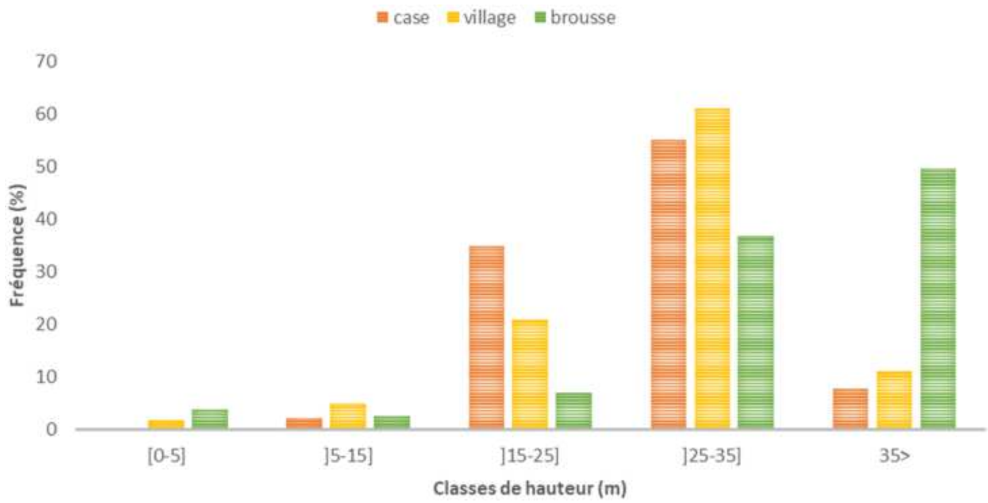

Figure 9. *Structures by height classes of park types.*

3.4.2. Structure by Diameter Classes

The structure of the baobab population according to diameter shows that the class [5-10m] contains the highest frequency of baobabs in the hut and village parks (Figure 10). On the other hand, for the bush park, the highest frequency of baobabs is in the class [1-5m].

3.4.3. Principal Component Analysis of the Variables Measured in the 17 Parks

According to the PCA (Figure 11), axis 1 and axis 2 absorb more than 75% of the contribution of the variables; the values are recorded in Table 3. Bush parks are characterised by high baobab height (HT), a high number of tiers (NbreP) with larger distances between baobab stands. In contrast, village parks are the group of baobabs with the largest trunk circumferences at 1.3 m (Cir.) and the largest crown diameters (Dhp). The hut parks are those with intermediate values compared to the bush and village parks.

It should also be noted that the height of the baobab, the number of bearings and the distances between the legs are positively correlated with each other, as well as between the diameter of the crown and the circumference of the trunk. The latter two parameters are negatively correlated with stocking density.

Figure 10. *Diameter class structures of park types.*

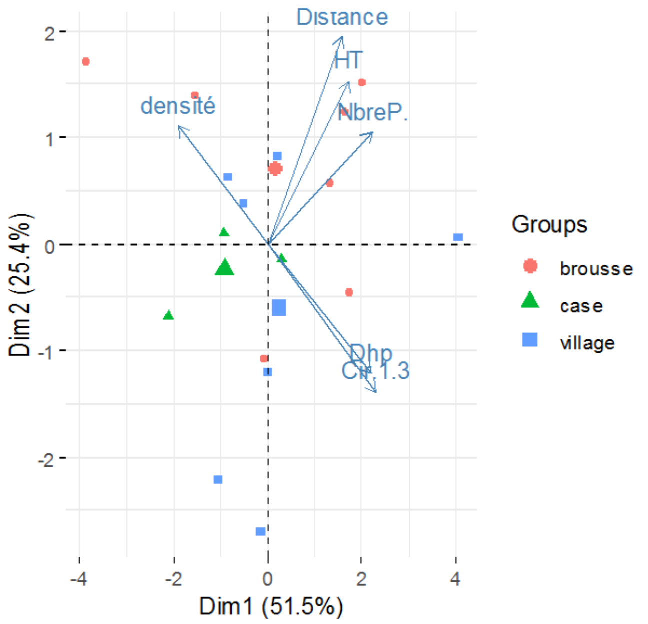

Figure 11. *PCA of variables measured in 17 baobab parks in Middle and Upper Casamance.*

4. Discussion

The village park, in which the baobabs are more distant from each other, also has the largest circumferences at 1.3 m and the largest crown diameters. However, according to the results, the correlation between distance and girth at 1.3 m is weak (r= 0.18). It is in this park where agriculture is well practised that Dossa and al. [15] point out the negative perception of its presence in the fields due to competition with crops because of the size of its crown and the importance of its vital space. For this reason, farmers in the area leave large distances between baobabs and often prune and/or cut them back in order to reduce this competition between baobabs and crops, and to favour the acquisition of nutrients and light. These large distances between baobabs favour the enlargement of their crowns and are at the origin of the larger crown diameters observed in the village parks despite the pruning carried out.

The bush parks have the highest baobabs with the largest number of tiers and smaller distances between them. This small distance between baobabs could be supported by the colonisation theory of Jansen and Connel [16, 17]. According to the Jansen-Connell model, this high density of adult trees is due to the increased density of seeds, which are sheltered from predators that are more inclined towards open spaces [16]. Such a situation would also mean good natural regeneration despite the high densities. It would also be the reason for the tendency of individuals to grow preferably in height with the greatest number of branches. This is because competition between baobabs is very fierce, hence their propensity to grow tall. Similarly, bush parks have a higher level of fruiting compared to other parks. This could be due, on the one hand, to the low level of pruning and/or pruning (12.6%) compared to hut parks (25.8%) and village parks (40.03%). It is noted that trees prized for their leaves are frequently mutilated to prevent them from producing flowers [9], which reinforces Savard's [21] statement that the injuries resulting from leaf collection disrupt the growth and reproduction of the baobab. On the other hand, due to the proximity of resources, pruning and/or trimming is generally early and severe in village and hut parks, whereas it is partial in bush parks. Thus, the perception of farmers is that the baobab only bears fruit when it is growing in the bush parks according to Bationo and al. [7].

As far as the hut park is concerned, it has the smallest diameters of the tree canopy mainly because of pruning for reasons of leaf collection, or safety so that they do not fall on the huts under the influence of the enormous amount of biomass and wind. Moreover, it is the most anthropised park with 57.3% of baobabs compared to village (55.2%) and bush (52.3%) parks. These results support Bationo's [14] idea that access to baobab park products depends on the type of park, the products sought and family rules. Furthermore, these results on anthropization rates are higher than those of the baobab parks of Bala, Koussanar (Tambacounda) and Dar

Salam (Kédougou), in Senegal, where the anthropization intensity amounts to 33%, 26%, and 42% respectively according to Sanogo and Tamba [18]. This shows the extent to which the parks of the Middle and Upper Casamance are anthropised and therefore threatened.

Furthermore, according to Tassin [19], in anthropised parks, an absence of young baobabs is often observed. This is in line with the baobab population structures in our results. Indeed, a very weak regeneration in village parks as well as in bush parks, or even absent in hut parks, was observed. This weakness or absence of young baobabs is due to the ageing of baobab populations whose renewal is not ensured by the weak natural regeneration and the absence of artificial planting. Indeed, baobab cultivation remains influenced by multiple socio-economic constraints [14, 7]. The time needed for the tree to start producing fruit, the optimism of the populations on the inexhaustible character of the resource and the existence of certain mystical beliefs constitute, in general, major obstacles for the local populations to plant and maintain young trees.

Similarly, species whose fruits are consumed, as is the case for baobab, generally encounter regeneration problems [20]. This is why Bationo and al. [6] point out that artificial regeneration of baobab remains marginal in the Sahel. Moreover, in most of the range where the trees are included in production systems, baobab populations are reportedly declining because young plants and stems do not receive sufficient protection to ensure their survival [9]. Another aspect, namely land tenure, could be a blocking factor. Indeed, according to Savard [21], in the Sahel planting a tree is a complex act, as planting a tree often means acquiring the land where it is planted. This is always a conflictual situation and not easy to overcome.

5. Conclusions

The study made it possible to characterise the baobab parks of the Middle and Upper Casamance. It should be noted that the results obtained show the typology of the parks and their state of degradation. Indeed, the results show three types of parks: hut, village and bush. The dendrometric characteristics measured (diameter, height, crown and number of branches) on baobabs showed significant differences between these three types of parks. Moreover, in all park types, the dominant baobabs are found in the last diameter and height classes, indicating an ageing population. In addition, anthropic pressure (pruning and/or trimming and debarking) is high on all baobabs, with harvesting methods associated with bushfires, overgrazing and field work that remain inappropriate for the survival of the species. These inappropriate methods negatively influence baobab productivity, especially fruiting, which is why the level of fruiting is higher in bush parks than in hut and village parks.

Acknowledgments - The authors would like to thank the Programme d'Appui au Développement de la Casamance (PADEC) for funding this study. They also thank the people who participated in the inventories such as Momar Wade, Mouhamed Diop, Aliou Seydi, Cheikh Diouf et El hadji Seydi.

References

[1] BERGERET, A. et RIBOT, J. C. (1990). L'arbre nourricier en pays sahéliens [The food tree in Sahelian countries], Ministère de la coopération et du Développement, Edition de la maison des sciences de l'homme, Paris, 237p.

[2] GANABA, S., OUADBA, J. M., BOGNOUNOU, O. (2002). Utilisation des ressources végétales spontanées comme complément alimentaire en Région sahélienne du Burkina Faso [Use of spontaneous plant resources as a food supplement in the Sahel region of Burkina Faso]. Annales de Botanique de l'Afrique de l'Ouest, 02: 101-111.

[3] CISSE, M. ET GNING, F. (2013). Les parcs agroforestiers à Adansonia digitata L. (Baobab) en Moyenne et Haute Casamance: opportunités et contraintes [Agroforestry parks with Adansonia digitata L. (Baobab) in Middle and Upper Casamance: opportunities and constraints]. Mémoire de licence, Université Assane SECK de Ziguinchor, 40pp.

[4] SIDIBE, M., WILLIAMS, J. T. (2002). Baobab. *Adansonia digitata* L. International Centre for under utilised Crops, Southampton, UK.

[5] BOFFA, J. (2000). Les parcs agroforestiers de l'Afrique subsaharienne [Agroforestry parks in sub-Saharan Africa]. Rome: FAO, 258p.

[6] BATIONO, B. A., LAMIEN, N., DEMERS, N., KANDJI, S. (2009). Culture du baobab *Adansonia digitata* L. (Bombacaceae) en planche maraichère: une méthode pour simplifier sa récolte et favoriser sa propagation au Sahel [Cultivation of the baobab *Adansonia digitata* L. (Bombacaceae) in market gardens: a method to simplify its harvesting and promote its propagation in the Sahel]. Bois et Forêts des Tropiques, 299: 79-86.

[7] BATIONO, B. A., MAÏGA, A., COMPAORE, P., KALINGANIR, A. (2010). Dimension socioculturelle du baobab *Adansonia digitata* L. dans le plateau central du Bukina Faso [Socio-cultural dimension of the baobab *Adansonia digitata* L. in the central plateau of Bukina Faso] in Bois et Forêts des tropiques, 2010, N°306 (4), 23-32p.

[8] ASSOGBADJO, A. E., KYNDT, F. T., CHADARE, J., SINSIN, B., GHEYSEN, G., EYOG-MATIG, O., VAN DAMME, P. (2008). Genetic fingerprinting using AFLP cannot distinguish traditionally classified baobab morphotypes in Agroforest Syst, DOI 10.1007/s10457-008-9157-y.

[9] ASSOGBADJO, A. E. et LOO, J. (2011). *Adansonia digitata* L., baobab. Conservation et utilisation durable des ressources génétiques des espèces ligneuses alimentaires prioritaires de l'Afrique subsaharienne [Conservation and sustainable use of genetic resources of priority woody food species in sub-Saharan Africa]. Bioversity International (Rome, Italie), 12p.

[10] NIKIEMA, R. (1996). Commercialisation des produits alimentaires et forestiers provenant des parcs agroforestiers: cas des marchés de Zitenga et Yako au Burkina Faso [Marketing of food and forest products from agroforestry parks: the case of Zitenga and Yako markets in Burkina Faso]. In E. G. Bonkoungou, E. T. Ayuk & I. Issaka, eds. Les parcs agroforestiers des zones semi-arides d'Afrique de l'Quest, p. 31–45. Actes du séminaire international, ICRAF/IRBET/CILSS/LTC, Ouagadougou, Burkina Faso, 25–27 Oct. 1993. Nairobi, Centre international pour la recherche en agroforesterie (ICRAF).

[11] SANOGO, D. (2015). Etat actuel des peuplements de baobabs (*Adansonia digitata* L.) au Sénégal: Statut écologique, potentiel de production et approches participatives supportant sa domestication [Current status of baobab (*Adansonia digitata* L.) stands in Senegal: ecological status, production potential and participatory approaches supporting its domestication]. Thèse unique Université Cheikh Anta Diop.

[12] MBAYE, T., DIA, D., TOURE, K., FAYE, N. F., SY, M. R., MANGA, A., SOW, M., DIALLO, A., SARR, M. N., DIOUF, A. (2016a) Stratégies de gestion durable des PFNL face aux menaces sur la ressource: cas des Régions de Tambacounda et de Kédougou au Sénégal [Strategies for the sustainable management of NTFPs in the face of threats to the resource: the case of the regions of Tambacounda and Kédougou in Senegal], Revue Science et Technique, Spécial hors-série n° 3 — Décembre 2016 — ISSN 1011-6028.

[13] NIANG, A., YOSSI, H. (2000). Le jardin de baobab à Ségou [The baobab garden in Segou]. L'indépendant. 340. 1 p.

[14] BATIONO, B., COMPAORE, A. et NIANG, A. (2004). Les parcs à baobab dans le Plateau Central du Burkina Faso: structure et contraintes socioculturelles à la régénération [Baobab parks in the Central Plateau of Burkina Faso: structure and socio-cultural constraints to regeneration] in Leçons tirées des expériences de lutte contre la désertification au Sahel: Actes des travaux de l'Atelier sous-Régional d'échange et de réflexion organisé par le Centre de recherches pour le développement international (CRDI), 12-16 juillet 2004, Saly Portudal, Sénégal; 72-79pp.

[15] DOSSA, K., TONI H., AZONANHOUN, P., DJOSSA, A. B. (2015). Caractérisation de quelques peuplements naturels de Baobab (Adansonia digitata L.) et des pressions subies dans les différentes zones chorologiques du Bénin [Characterization of some natural stands of Baobab (*Adansonia digitata* L.) and the pressures suffered in the different chorological zones of Benin]. Journal of Applied Biosciences 93: 8760-8769.

[16] JANSEN, D. H. (1970). Hernivore and the Number of Tree Species in Tropical Forests. American Naturalist 104: 940.

[17] CONNELL, J. H. (1971). "On the role of natural enemies in preventing competitive exclusion in some marine animals and in rain forest trees." In: Dynamics of Population. Ed. P. J. Den Boer and G. R. Gradwell. Wageningen: Pudoc. Wageningen, The Netherlands.

[18] SANOGO, D., TAMBA, A. (2012). Inventaire des Parcs de Baobab et du potentiel pain de singe dans les CR de KOUSSANAR et BALA dans la Région de Tambacounda et la CR de DAR SALAM dans la Région de Kédougou [Inventory of Baobab Parks and fruit potential in the communes of KOUSSANAR and BALA in the Tambacounda Region and the commune of DAR SALAM in the Kédougou Region].

[19] TASSIN, J. (2010). Baobabs: un genre particulier [Baobabs: a special kind] in Bois et Forêts des tropiques, 2010, N°306 (4), 4-5p.

[20] THIOMBIANO, D. N. E., LAMIEN, N., DIBONG, S. D., BOUSSIN, I. J. (2010). Etat des peuplements des espèces ligneuses de soudure des Communes rurales de Pobé-Mengao et de Nobéré (Burkina Faso) [State of the stands of woody species in the rural communities of Pobé-Mengao and Nobéré (Burkina Faso)]. Journal of Animal & Plant Sciences. Vol. 9, Issue 1: 1104-1116.

[21] SAVARD, V. (2003). Evaluation du potentiel d'adoption des parcelles maraîchères de baobab (*Adansonia digitata* L.) dans la Région de Ségou, au Mali [Evaluation of the adoption potential of baobab (*Adansonia digitata* L.) market garden plots in the Segou Region, Mali)], mémoire de Master Université de Laval, Octobre 2003. 127p.