B A S E *Biotechnol. Agron. Soc. Environ.* 2025 **29**(1), 41-52 OPEN ACCESS

Borassus akeassii among the Turka. The uncertain future of a cultivated palm in southwestern Burkina Faso

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Received 12 January 2024, accepted 25 February 2025, available online 26 February 2025.

DOI: 10.25518/1780-4507.21077

Description of the subject. *Borassus akeassii* Bayton, Ouédr. & Guinko is a multi-purpose species cultivated by various ethnic groups in southwestern Burkina Faso. These palm's populations are undergoing significant transformations due to human activities.
Objectives. This study aims to explore the structural characteristics and population dynamics of the palm tree, *B. akeassii*, in southwestern Burkina Faso, particularly in the Turka region.
Method. The study is based on ethnographic surveys conducted among local populations, combined with ecological data.
Results. The results highlight a predominance of juvenile palms, a balanced sex ratio among adult palms, generally satisfactory palm population health, and low mortality among adult palms due to controlled exploitation. Palm stands are currently affected by profound socio-economic changes. This has results in a loss of the social and economic value of the palm tree and the abandonment of traditional practices. Consequently, the abundance and condition of palm stands have deteriorated.
Conclusions. The decisive factor in the dynamics of the palm stands appears to be the decrease in the social and economic profitability of the plant. The ancestral values and connections between *B. akeassii* palm and the local populations are currently being deconstructed. *Borassus akeassii* being cultivated in the region, the local population's lack of interest in this plant and its products will lead to its replacement by other crops in areas reserved for agricultural activities.
Keywords. Arboriculture, Arecaceae, cultivation, dynamics, knowledge, West Africa.

***Borassus akeassii* chez les Turka. L'avenir incertain d'un palmier cultivé dans le sud-ouest du Burkina Faso**
Description du sujet. *Borassus akeassii* Bayton, Ouédr. & Guinko est une espèce de rônier à usage multiple, cultivée par diverses sociétés dans le sud-ouest du Burkina Faso. Ces rôneraies font face à d'importantes transformations dues aux activités humaines.
Objectifs. Cette étude vise à explorer les caractéristiques structurales et les évolutions des populations du palmier *B. akeassii* dans le sud-ouest du Burkina Faso, particulièrement en pays turka.
Méthode. L'étude s'appuie sur des enquêtes ethnographiques menées auprès des populations locales, combinées à des données écologiques.
Résultats. Les résultats montrent une prédominance de palmiers juvéniles, un sex-ratio équilibré chez les adultes, un état sanitaire globalement satisfaisant et une faible mortalité parmi les palmiers adultes grâce à une exploitation contrôlée. Cependant, les rôneraies subissent de nos jours de profonds bouleversements socio-économiques, ce qui a entraîné une perte de leur valeur sociale et économique, ainsi que l'abandon des pratiques traditionnelles. En conséquence, l'abondance et la qualité des peuplements de palmiers se sont détériorées. Ces données sont essentielles pour évaluer l'état de conservation des rôneraies dans la région, suivre leur évolution et planifier leur gestion face aux menaces actuelles.
Conclusions. Le facteur décisif dans la dynamique des rôneraies est la diminution de la rentabilité sociale et économique de la plante, celle-ci semble être attribuable aux divers changements sociétaux. Cette étude révèle également que les valeurs et les liens ancestraux entre les palmiers rôniers et les populations locales sont en train de se déconstruire. Le manque d'intérêt des populations locales pour le palmier *Borassus akeassii* risque de conduire au remplacement de ce dernier par d'autres cultures dans des zones réservées aux activités agricoles.
Mots-clés. Arboriculture, Arecaceae, pratique culturale, dynamique, perception, Afrique de l'Ouest.

1. INTRODUCTION

Borassus akeassii Bayton, Ouédr. & Guinko, a palm tree native to the Sudanese and Sudan-Guinean savannahs was long mistaken for the species *Borassus aethiopum* (Bayton et al., 2006). In Burkina Faso, populations of *B. akeassii* are mainly found in the western part of the country and are particularly present in the western provinces of Houet, Kénédougou, Léraba, and Comoé (Thiombiano et al., 2012). The species is cultivated by local populations in many ethnic groups. Among the Turka and other ethnic groups in the south-western region of the country, the palm tree population have been shaping the lives of local communities for centuries (Tauxier, 1933). Therefore, this plant holds symbolic and heritage value for this society. Numerous studies have been conducted on the uses, economic significance, and social importance of this palm in the southwest of Burkina Faso (Portères, 1964; Cassou et al., 1997; Yaméogo et al., 2008; Coulibaly, 2017). In the "rural commune" (one of Burkina Faso's administrative divisions) of Wolokonto, in the Turka region, palm tree populations have been maintained and exploited by the inhabitants for centuries, providing many services to the people (Cassou, 1996). Today, the Turka region is undergoing demographic growth and urbanization, leading to changes in the structure of the palm stands and jeopardizing the future of *B. akeassii*. The main factors include pressure on land to build housing and infrastructure, leading to deforestation, loss of natural habitat and a reduction in palm stands. Cultural shifts are also at play. Traditional knowledge of *B. akeassii* management is declining due to modernization, migration, and changing lifestyles. The younger generations are now concentrating on alternative livelihoods to palm growing. Migration driven by economic opportunities or conflicts increases competition for land. This leads to overexploitation of palm resources, or the conversion of palm stands into agricultural or commercial land. Such societal changes increase the threats and the vulnerability of the plant in the region (Béné et al., 2022). As pressure on the plant's habitats increases, it is crucial to consider the future of this palm in the region and examine how these societal changes influence its conservation and sustainability. Until recently, Palmyra palm stands were well maintained and widely used by local populations. To ensure the conservation of this species in the current context, that of the Anthropocene, it therefore seems important to understand the ideas and practices of local populations as well as the issues related to the current management of these environments (Bridgewater, 2016; Luke et al., 2020).

Indeed, biodiversity preservation ranks among the essential priorities in the development process (Naeem et al., 2016; Kelbessa, 2022). However, the essential mechanisms for maintaining this biodiversity and the elements responsible for its evolution often remain poorly understood (Ogwu et al., 2022). Nowadays, it is acknowledged that the conservation of plant biodiversity necessarily involves understanding the interactions between it and the access and utilization practices derived from human activities (Mbayngone et al., 2008; FEM, 2010). Thus, residents of a region are more inclined to actively preserve biodiversity elements such as species and ecosystems, along with the ecological processes underpinning them, when they perceive these elements as useful or of great importance. Therefore, this study adopts both an ethnographic and ecological approach to capture and analyze the key factors influencing the dynamics of *B. akeassii* populations in Wolokonto. Its objective is to take stock of the status of the *B. akeassii* population in the village of Wolokonto (spatial structure and age classes) and to identify the threats currently weighing on their survival. This should make it possible to develop conservation strategies for this species adapted to the local context.

2. MATERIALS AND METHODS

2.1. The inhabitants and their vegetal landscape

The study focuses on the Turka society in the municipality of Wolokonto, located in the southwest of Burkina Faso, between 10°35′30″ and 10°44′30″ North latitude, and 4°56′30″ and 5°04′30″ West longitude. It encompasses two villages (Wolokonto and Malon) within the administrative region of Cascades (**Figure 1**). The Turka language is part of the Gur language groups of the Niger-Congo family. The municipality has the lowest population density in the country, with 5,504 inhabitants according to the 5th general census of the population in Burkina Faso in 2019 (INSD, 2020). The "rural commune" falls within the southern part of the Sudanian climatic zone, characterized by a tropical climate with two seasons: a dry season (November to May) and a rainy season (June to October), with annual rainfall reaching over 1,100 mm (National Meteorological Agency of Burkina Faso, 2020). The vegetation in this region is characterized by Sudanian and Guinean tree species, such as *Combretum nigricans*, *Crossopteryx febrifuga*, *Burkea africana*, *Terminalia laxiflora*, *Terminalia macroptera*, *Pterocarpus erinaceus*, *Isoberlinia doka*, *Anogeissus leiocarpus*, *Vitellaria paradoxa*, *Parkia biglobosa* and *Prosopis africana* (IFN, 2016). **Figure 1** shows that, in addition to fields, other types of land use and occupation are observed in the municipality. These include orchards where numerous species are cultivated, typically for fruit production. There are also

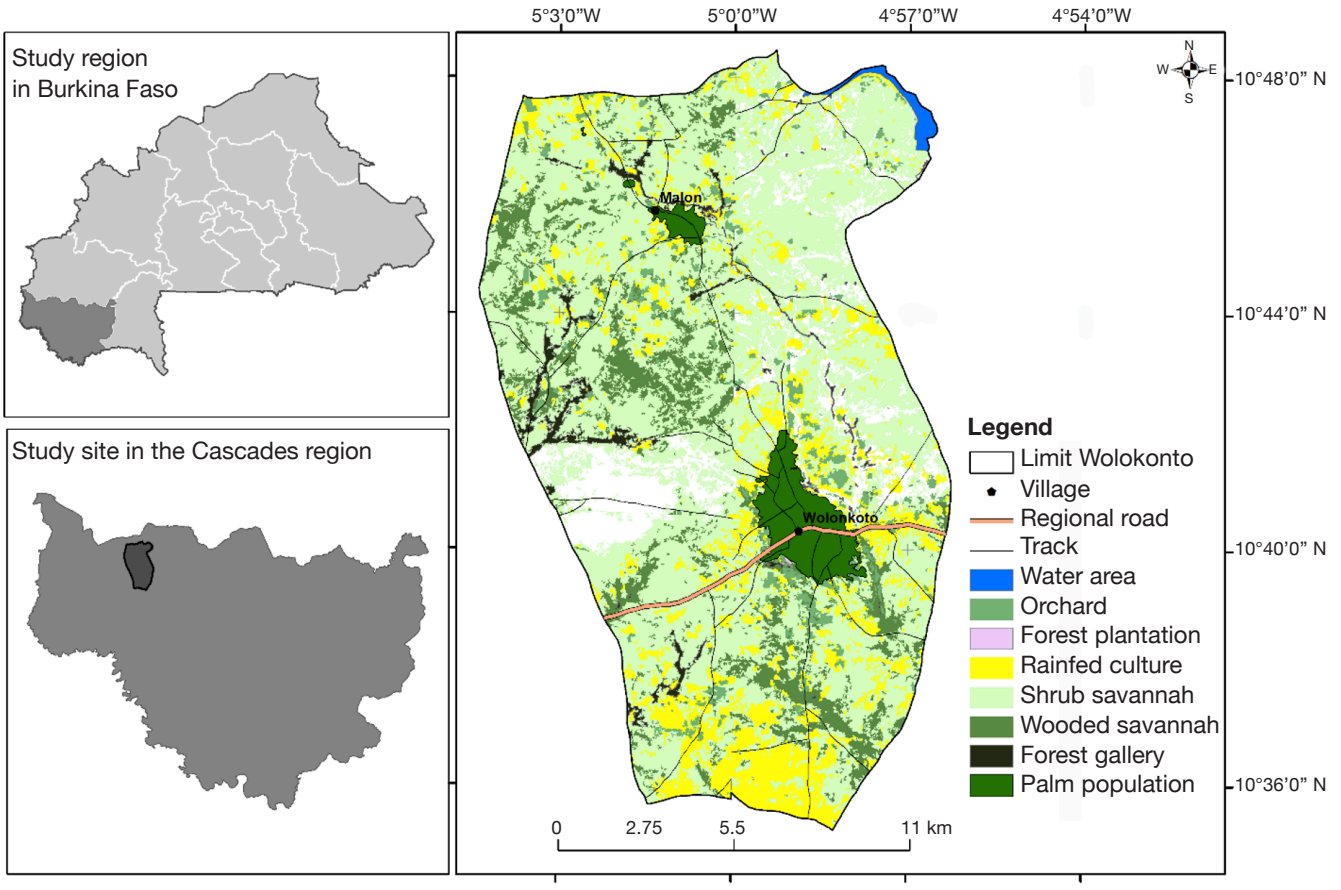

Figure 1. Land use in the administrative region of Cascades and location of the village of Wolonkoto — *Utilisation des terres dans la région administrative des Cascades et emplacement de Wolonkoto*.

Sources: IGB, 2012 ; IGB, 2014.

forest plantations, often dedicated to wood production, reforestation, or ecosystem restoration. Such areas are generally managed by the municipality. Spontaneous vegetation, such as forests, gallery forests, and savannas, also exist but are regularly encroached upon by agricultural activities.

2.2. *Borassus akeassii:* botanical characteristics and introduction of its cultivation in Wolonkoto

The agricultural landscape of Wolokonto is characterized by extensive stands of *Borassus akeassii* palm trees, exploited by the local populations. *Borassus akeassii*, a dioecious palm tree, was first described in Burkina Faso in 2006 (Bayton et al., 2006; Bayton & Ouédraogo, 2009). It is locally very common in the southwestern part of the country and is cultivated on well-drained and light soils. Arbonnier (2002) provides a detailed description of the species, stating that it is fire-resistant and can reach heights of 20 to 25 m. It has a straight, smooth, light gray stem with a diameter ranging from 30 to 60 cm. The fruit consists of pendulous clusters, weighing between 25-50 kg at maturity, and typically containing three seeds. The origin of these *B. akeassii* palm trees in Turka territory is ambiguous. However, the most widely accepted thesis, supported by a majority of elderly people, is that it was introduced to the region by man. The Turka possess a deep knowledge of the plant, transmitted from generation to generation, including traditional practices of planting and managing the palm tree (Béné & Fournier, 2021). They master techniques for tapping the palm sap, germinating seeds, and transplanting seedlings. Furthermore, beliefs and rituals related to palm tree cultivation reflect their close relationship with this emblematic tree, these have contributed significantly to the preservation and sustainability of palm cultivation in Turka society.

2.3. Sampling and data collection

Method and devices for collecting geographical and ecological data. The comprehensive census of palm stands was conducted between June 2021 and March 2022, along predefined tracks (Wong, 2000; Azihou et al., 2013) selected using topographic data (IGB, 2014) and land use data (IGB, 2012). The maps were produced using ArcGIS 10.5 software and were based

on the geographic coordinates collected in the palm stands studied. The information provided by residents was also used to identify and describe palm stands in the municipality, considered as a participatory mapping. Preliminary surveys among the inhabitants (traditional local leaders, village development committees' leaders, and especially local populations) first helped to identify local typologies of palm tree populations (**Figure 2**), which vary slightly among the residents. These criteria can be social (palm population belonging to individuals, clans or neighborhoods) or structural (varying in size). As the "neighborhood" (district in a village) was the most frequently criterion mentioned by the inhabitants, it was chosen as the most appropriate for establishing our typology. Consequently, within the four neighborhoods of the village, a balanced sampling approach was adopted, with three sampling plots per neighborhood. As suggested by Sheil et al. (2003), the sampling plots' size was not the same in each sample in order to always comprise a contiguous set of 50 adult individuals in a quadrilateral, whose physiognomy and organization were deemed to best reflect the overall palm population. In all, over 600 mature palm trees were surveyed and assessed on 12 plots. The selection process was conducted in a participatory manner with the local populations. In each sampling plot, all palm individuals were counted and categorized into four distinct development classes based on their morphology, as proposed by Barot & Gignoux (1999). Depending on their developmental stage (adults or juveniles), the collected variables naturally differed (**Table 1**). For example, the gender could be directly determined for adult palms only by the presence of male inflorescences or mature fruits either on the plant or fallen nearby. Palms owners and operators also contributed to providing information on this variable. Whenever possible, on-site spot surveys in the palm population were conducted to gather information on human activities directly or indirectly affecting the palm and its habitat. A floristic inventory of the woody vegetation associated with the palms was also conducted. The number of all woody plants present in the sampling plots and their species were recorded. Furthermore, based on the geographical coordinates of the study plots, on the one hand, on maps from the National Soil Office of Burkina Faso (BUNASOLS, 2015) on the other hand, the soil type of each palm stand was identified.

Figure 2. *Borassus akeassii* palm tree stands in Wolokonto in southwest Burkina Faso — *Rôneraie de* Borassus akeassii *à Wolokonto au sud-ouest du Burkina Faso*.

Ethnoecological survey. Ethnographic surveys on the practices and representations of the palm were conducted using classical methods, including open-ended and semi-structured interviews (Olivier de Sardan, 2003). The interviews were conducted between June and August 2021, with 63 key informants, both men and women, all aged over 30 years, which corresponds to a sampling rate of 7.22%

Table 1. Characterisation of the four developmental stages of the plant and the corresponding recorded variables (based on Barot & Gignoux, 1999) — *Caractérisation des quatre stades de développement de la plante et des variables enregistrées correspondantes (basé sur Barot & Gignoux, 1999).*

Stage	Character	Leaves	Stem	Measured variables
4	Adults	Fan-shaped	Massive	Height Stem circumferences (base and at 1.30 m above ground) Number of fronds/palms Gender/sex Geographic coordinates Evidence of exploitation Mortality Physical condition/state
3	Juveniles	Fan-shaped	Only for older juveniles	Height Geographic coordinates Physical condition
2	Seedlings with split leaves	Several times split	No	
1	Seedlings with split leaves	Fully elongated	No	

of this age group within the population of Wolokonto. These individuals were particularly knowledgeable about the practical and spiritual aspects of the palm (family heads, traditional leaders, operators, etc.). The selection of these informants, who had a close relationship with the palm, was done with the assistance of customary, and administrative authorities and the inhabitants in general. The interview guide, inspired by the standard protocol (Cámara-Leret et al., 2015), consisted of several open-ended questions to allow the informants to express themselves as freely and comprehensively as possible. The conversations focused on management practices and the evolution in the uses related to the palm. The interviews were mainly conducted in the Dioula language and, to a lesser extent, in the local language (Turka), with the help of an interpreter.

2.4. Data analysis

Local perceptions and practices on social changes. In the first step of our analysis, we extracted from the semi-structured survey data frequently recurring themes or ideas related to the cultivation of *B. akeassii*, some very general, other more specific (see **table 2** in results below). To assess the relative importance given by residents to the different themes ("factors" in the subsequent comments), their frequency in their responses was calculated. Less frequent responses were subject to qualitative analysis. Topics covered included management practices, uses and perceptions of *B. akeassii*, as well as changes in the palm populations. The analysis focused mainly on concrete actions that can influence palm population dynamics and, on the statements, describing a temporal dynamic. The interpretation of the results involved comparisons and cross-referencing of the speeches of the people surveyed.

Population structure and dynamic of palm population. Descriptive statistics and analyses of variance (one-way) followed by comparisons of two-to-two means (Tukey test) were calculated for morphological parameters measured according to different stages of development and palm population types. The relationships existing between these morphological characteristics of palm populations were investigated using factor analyses of multiple correspondences, performed with the R software, version 4.3.1 (R Core Team, 2023). Height was chosen as the main indicator to describe the dynamics of palm stands. Indeed, unlike for "real" trees the diameter of which is strongly related to age (Dagnélie & Rondeux, 1971; Bouchon, 1979), the thickness of the palm stem may decrease over the years (Barot & Gignoux, 1999). Thus, height proved to be the best indicator for estimating the age of a palm tree. Ethnographic data collected from local informants were of particular interest in understanding the management logic of palm populations. They also provided the necessary basis for the understanding of the palm dynamics of the commune.

3. RESULTS

3.1. Distribution and characteristics of *Borassus akeassii* populations in Wolokonto

Borassus akeassii is the only species of the genus found in the Wolokonto palm stands. The other species growing spontaneously in Burkina Faso, *B. aethiopum* Mart., has not been observed there. In the two villages that make up the commune of Wolonkoto, the population of *B. akeassii* is divided into two large blocks that cover an area of 946.15 ha (**Figure 1**). In addition, there are also about a hundred palm trees which are isolated trees scattered in fields, near dwellings, in savannahs, along watercourses, and even in areas designated for market gardening. The scattered palm trees are not included in the map we have drawn up. In the blocks, the palm tree populations are composed of numerous palm individuals of different sizes and ages, usually without following a specific arrangement order. Nevertheless, we did observe a few individuals lined up in rows, as well as others placed on the edges of fields. Most palm tree populations are established in rainfed crop areas and agroforestry territories, including residential zones. *Borassus akeassii* is mixed to varying degrees with other species, cultivated exotic woody plants and native trees spared during clearing. These species are primarily those of high economic interest and those which provide non-timber forest products. Among the most common are *Elaeis guineensis*, *Faidherbia albida*, *Anacardium occidentale*, *Mangifera indica*, *Terminalia macroptera*, *Tectona grandis*, *Parkia biglobosa*, *Ficus sur*. Harvested palm trees (for sap and leaves) are easily recognizable due to the presence of rings on their stems and the absence of leaves, including petioles. Sap extraction produces distinct and regular constrictions, making it easy to differentiate between exploited and non-exploited trees. The harvesting of petioles is particularly visible, giving the palm populations a distinctive appearance, although traces of sap collection are also visible. More than 80% of the recorded palm trees show traces of petiole harvesting. The palm trees are primarily found on soils rich in iron or manganese sesquioxide, belonging to the subclass of ferruginous tropical soils, which can be leached, hardened, mottled, or exhibit concretions.

Table 2. Ranking of the factors influencing the palm cultivation activity according to the Turka from Wolonkoto — *Classement des facteurs influençant l'activité de culture du palmier selon les Turka de Wolonkoto*.

Theme	Description and observation	Citation frequency (%)
Profitability of palm trees cultivation	Decline in the economic and social profitability of palm-based products is severely affecting the cultivation of the plant	96
Urbanisation	Fragmentation and destruction of palm tree populations	94
Economic diversification	Expansion of the informal sector (market gardening, trade, etc.) is impacting palm cultivation	82
Attraction to palm trees cultivation	General lack of appeal of palm trees within the community has been noted by the majority	72
Use of palm products	Traditional use of palm products, including palm wine, is diminishing	45
Abandonment of traditional activities related to palm	Young people are abandoning sap extraction in favor of more profitable activities	20
Transformation of palm stands	Some palm groves are being converted into orchards of other species that are more profitable for local populations	10

3.2. Social changes and local perceptions of the dynamics of *Borassus akeassii*

According to our results, social changes have strongly impacted palm populations in the Turka region. At the same time, significant changes in local perceptions regarding *B. akeassii* dynamics have occurred (**Table 2**). Once considered a true social, economic, and cultural heritage, *B. akeassii* has seen its significance evolve among the Turka people over the past decades. In Wolokonto, even though the planting and cultivation of the palm are not as common as they used to be, respondents believe that natural regeneration is largely sufficient to ensure the survival of palm tree populations. These societal changes in the community are influenced by a variety of complex, dynamic and interconnected factors. Population growth, the abandonment of traditions, and the decreasing social and economic value of the palm were the main indirect factors discussed during the exchanges. The accelerated urbanization is the most important factor cited by the Turka of Wolokonto (94%). Indeed, like other surrounding ethnic groups, they are experiencing rapid population growth and significant expansion of the residential areas. Respondents assert that this phenomenon has intensified with the arrival of other displaced populations due to terrorist attacks in several locations across the country since 2016. They think that this demographic dynamic is impacting the traditional socio-economic system. Another indirect threat to the palm tree populations mentioned by a large majority of respondents (72%) is their current lack of general appeal within the community. The majority of respondents (96%) believe that the reduction in economic and social profitability of palm products has had a considerable impact on the cultivation of the plant. According to them, income solely derived from traditional sap extraction can no longer sustain a family's needs. Nowadays, palm operators' activity is primarily limited to the trade of its leaves (including petioles).

According to the elder's respondents (20%), young people are abandoning the labor-intensive and less profitable sap extraction in favor of other activities such as trade, tree cultivation and horticulture. Moreover, most of the sap extractors encountered in the village during our visits come from a different society. Palm stands undergoing significant changes were observed, with some being converted into more profitable plant orchards. In these types of land use, the palm is often felled to make way for other crops. The traditional use of palm products, including the wine for social ceremonies (rituals, weddings, etc.), is diminishing over the years. Only a minority of respondents (5%) claim to continue using palm products, including wine, during social events. The diversification of economic activities, particularly the expansion of the informal sector, was also mentioned by over 80% of the respondents as having a strong impact on palm cultivation in Wolokonto. The younger generation is no longer drawn to the palms due to the decline in their social and economic value. Respondents (94%) also discussed the relationship between the transformation of the village into a town and its potential consequences on palm tree populations. In the field, we observed that a significant portion of the palm tree populations in the village of Wolokonto is currently being divided into residential plots the allocation of which to owners has already begun. The occupation of these plots will likely lead to fragmentation and even partial or total destruction of palm tree populations.

3.3. Structure and dynamics of palm tree populations in Wolokonto

The average density of the palm stands in Wolokonto is 166 adult palms·ha^{-1}, with variations between the neighbourhoods. Adult palms have an average height of 7.41 m and average circumferences of 88.17 cm at the base of the stem and 74.92 cm at breast height (1.30 m above the ground). On average, each adult palm has 14 leaves. The analysis of variance (one-way) conducted at a 5% significance level between the variables (circumferences, height and leaf number) in the four neighborhoods reveals significant differences with highly significant values ($p < 0.000$).

Comparisons of means, conducted using the Tukey test, highlight groups of similar palm trees for each variable (**Table 3**). The mean basal circumference of palms varies between sites. Tarkon has the largest mean circumference (95.01 cm), significantly different from all other sites, while Dia, Flaré, and Tiona show similar means. Variability is highest in Tarkon (± 29.97 cm), whereas the other sites exhibit more uniform measurements. The HDP (diameter at breast height) circumference shows slight variation, with Tarkon (78.37 cm) significantly higher than Flaré (73.09 cm) and Tiona (73.04 cm). At Dia, the HDP circumference (75.18 cm) does not differ significantly from the other sites. Variability is again greater in Tarkon (± 19.99 cm). These differences in size and circumference likely reflect more favorable environmental or management conditions in Tarkon.

Palm height also shows significant variation between sites. Tarkon (8.56 m) and Dia (7.89 m) have the tallest palms, with no significant difference between them. Palms at Tiona (7.04 m) are significantly shorter than those at Dia and Tarkon, while those in Flaré (6.18 m) are considerably smaller. Height variability is similar at Dia, Tarkon, and Tiona, whereas Flaré displays slightly less variation. This suggests that the conditions in Tarkon and Dia are more conducive to a greater palm height.

Similarly, there is significant variation in the mean number of palm leaves across sites. Tarkon exhibits the highest mean number of leaves (18.18), followed by Dia (15.66) and Flaré (13.88), with Tiona having the fewest (11.26). The standard deviations indicate high variability in Tarkon (± 8.41) and Tiona (± 8.02), while Flaré (± 6.24) shows less variability. These findings suggest that palms in Tarkon have more leaves, whereas palms in Tiona have fewer, likely due to heavy exploitation.

In terms of adult palm density, Flaré has the highest density (271.6 palms·ha^{-1}), while Dia (150.84) and Tiona (167.8) exhibit similar but lower density. Tarkon has the lowest density (74.3 palms·ha^{-1}), significantly different from the other sites. The standard deviations reveal high variability in Flaré (± 127.6), whereas the other sites show lower variability (± 14.48 to ± 37.0), indicating that Flaré has a more variable palm density, while Tarkon has the lowest.

Variance analyses did not show statistically significant differences between the neighborhoods regarding the density of young palms (stages 1, 2, and 3), and the number of cut or dead individuals.

Figure 3, based on a multiple correspondence analysis, shows a higher prevalence of female individuals in the palm orchards at Tarkon. Growth stages 2 and 3 are mainly found in Tiona and Dia, while stage 1 palms are predominantly present in Flaré. Additionally, palms cut for domestic use are more common in Tiona and Dia. The figure also highlights the existence of numerous individuals whose sex could not be identified.

The left-skewed distribution of palm trees by height classes (**Figure 4**) indicates a predominance of palms in stage 1. Over 90% of individuals were less than 1 m tall, which reflects abundant seed production and high germination rates. Stage 3, on the other hand, is rare due to the short duration of the transition phase between juvenile and adult palms. However, a significant loss of individuals under 1.5 m, particularly in stages 2 and 3, is observed. These findings align with the conclusions of the ethnological surveys. Residents report that the fruits are now eaten less, so that when they reach maturity, they fall to the ground where they germinate. Because of the size and weight of its seeds, the plant spreads by gravity, in the immediate vicinity of the mother plant. Nevertheless, the fortuitous movement of

Table 3. Mean values of physical descriptors of palm trees — *Valeurs moyennes des descripteurs physiques des palmiers.*

Site	**Base circumference** (cm)	**HDP circumference**	**Total height**	**Sheets number**	**Adult density**
Dia	85.20 ± 19.24^{b}	75.18 ± 13.85^{ab}	7.894 ± 2.726^{a}	15.669 ± 7.507^{b}	150.84 ± 14.48^{ab}
Flaré	85.27 ± 21.18^{b}	73.09 ± 13.01^{b}	6.186 ± 2.177^{c}	13.886 ± 6.244^{b}	271.6 ± 127.6^{a}
Tarkon	95.01 ± 29.97^{a}	78.37 ± 19.99^{a}	8.560 ± 2.750^{a}	18.184 ± 8.415^{a}	74.3 ± 28.9^{b}
Tiona	87.35 ± 21.47^{b}	73.04 ± 13.28^{b}	7.046 ± 2.334^{b}	11.268 ± 8.024^{c}	167.8 ± 37.0^{ab}

For each descriptor, sets of palms (a, b and c) are grouped according to their similarity — *Pour chaque descripteur, des ensembles de palmiers (a, b et c) sont regroupés selon leur similarité.*

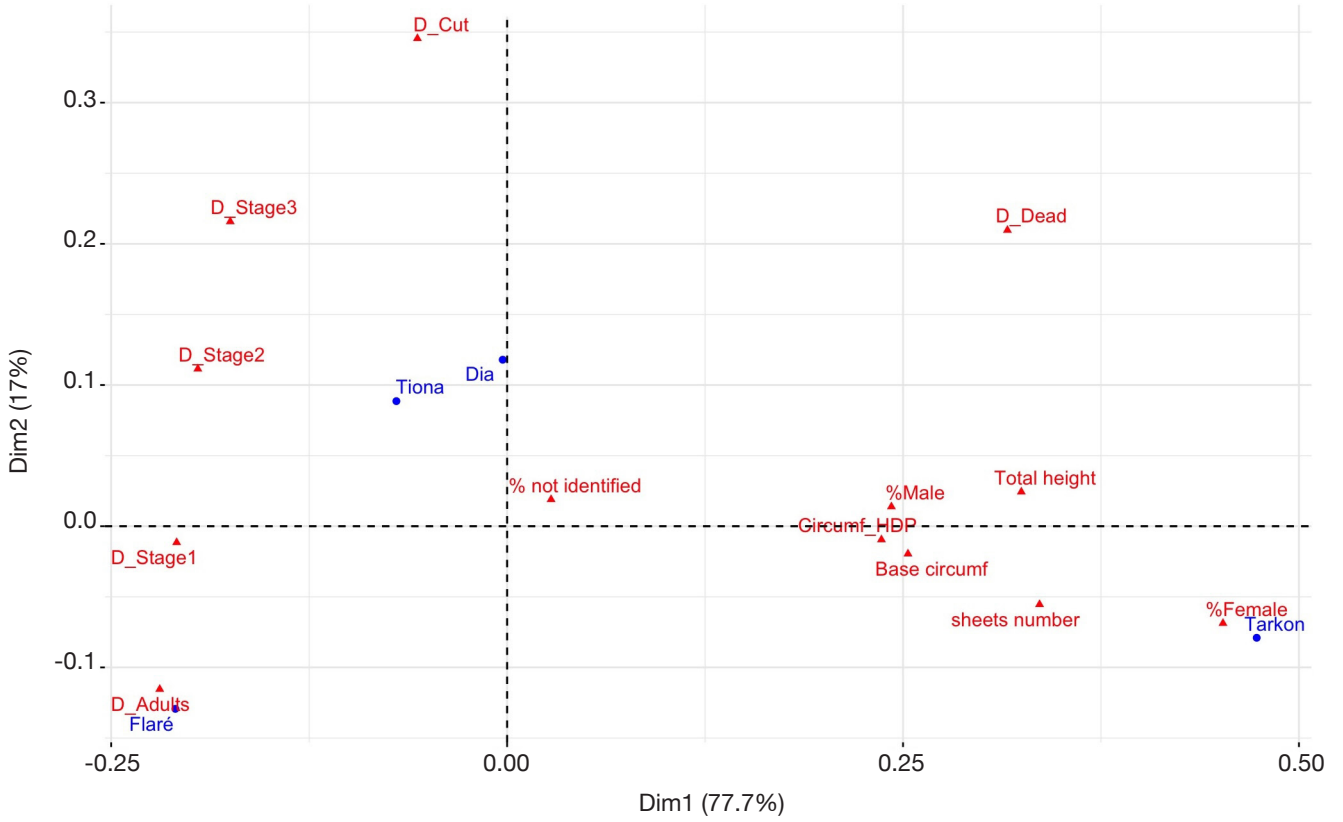

Figure 3. Relationship between the physical and structural characteristics of palm stands in the neighborhoods of Wolokonto (from correspondence factor analysis) — *Relation entre les caractéristiques physiques et structurelles des peuplements de palmiers dans les quartiers de Wolokonto (à partir d'une analyse factorielle de la correspondance).*

D: density — *densité*; Circumf: circumference — *circonférence*; HDP: diameter at breast height — *diamètre à hauteur de poitrine*; palm stands — *palmeraies*: Dia, Tiona, Tarkon, Flaré.

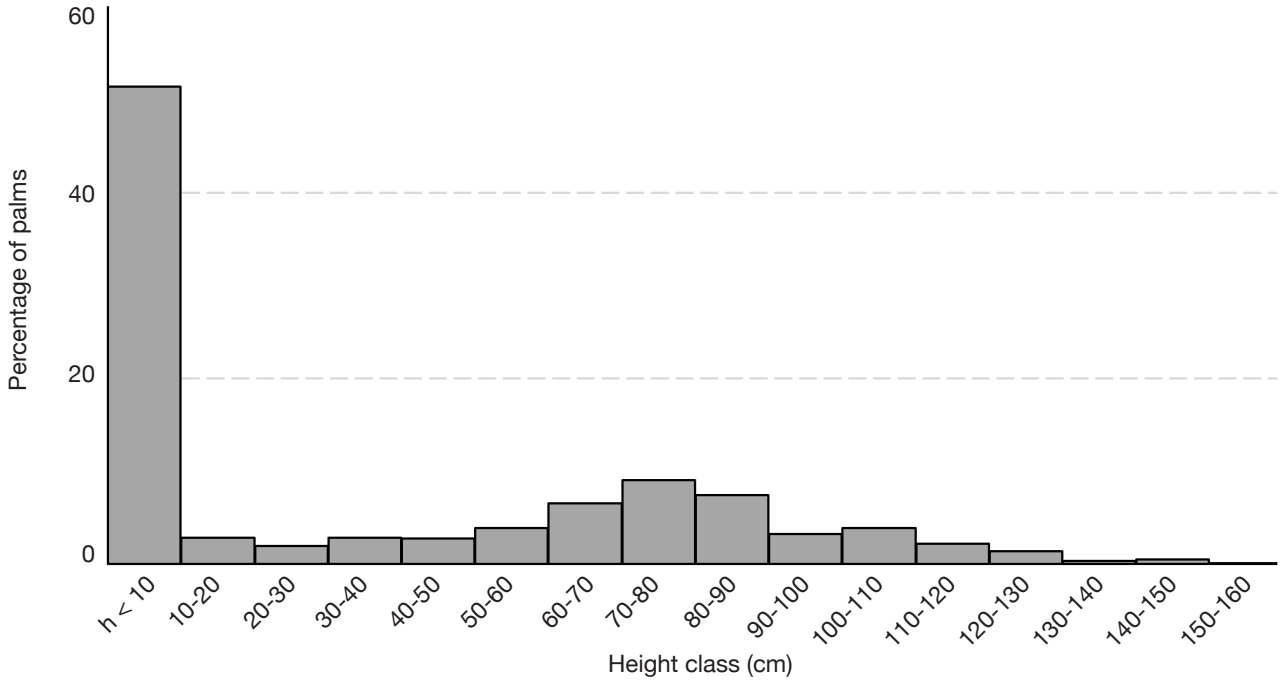

Figure 4. Height classes in the *Borassus akeassii* palm population in Wolokonto — *Classes de hauteur dans la population de palmiers* Borassus akeassii *à Wolokonto*.

fruit by animals and humans has been reported. Initially numerous, individuals in stage 1 decrease substantially thereafter. To make way for annual crops, field owners eliminate a portion of this regeneration between stages 2 and 3. Once widely planted, palms have been regenerating naturally in fields for around two decades.

Among all the adult palms inventoried, the sex of only 41% could be identified. Among these, the sex ratio is 0.70 female palms to 1 male palm, around 41% being female. This sex ratio is representative of what appears suitable for ensuring reproductive success and species sustainability. Overall, the health status of palms is good, only 5% of the studied individuals being in poor condition. The latter are mostly old palms subjected to repeated field fires and prolonged exploitation. Despite the regular exploitation of leaves of adult individuals for handicrafts and wine, mortality remains low due to proper management during this exploitation. However, some mortality caused by human removal (20 palms·ha^{-1}) and strong winds (less than 20·ha^{-1}) has been observed. According to local populations, individuals destined for felling are selected and cared for from a young age. When they reach full growth, their stems are harvested and used as domestic materials, particularly for construction (beams and planks). This age-old practice is observed in all neighborhoods. The regular leaf exploitation is considered by the inhabitants as beneficial for the plant. For them, reducing the leaf mass of the palm significantly contributes to minimizing the risk of breakage or uprooting by strong winds, especially during the rainy season when the ground is saturated with water.

4. DISCUSSION

The origin of *B. akeassii*, which in Burkina Faso is only found cultivated, is uncertain. In Côte d'Ivoire, however, this palm occurs spontaneously in a mixture with *B. aethiopum* and the two species show strong phenotypic variations (Akaza et al., 2022). As these characteristics may indicate a center of speciation or hybridization between species, inventories and research into these two *Borassus* must be continued. Given the current state of the data, the most likely hypothesis is that *B. akeassii* was introduced into Burkina Faso from Ghana around the 15th century (Béné & Fournier, 2021; 2024). The Turka were not the first owners of the Palmyra palm in Burkina Faso, as they are said to have received it from their neighbors the Karaboro. The latter claim they have received it themselves from a defunct group whose name has been forgotten. First adopted in Burkina Faso as a famine plant for the wine it produced, the plant was then used as a support for many uses (construction, basketwork, traditional medicine). The palm having aroused great interest among the people of western Burkina Faso, it was gradually passed on from one ethnic group to another, along with the knowledge associated with it. Many uses for the plant were locally developed and an original technique for producing wine that was not lethal to the exploited plant was even invented. Despite the preconceived ideas expressed by some authors (Zon et al., 2022), traditional methods of sap extraction are sustainable and do not lead to the death of the plant.

As economic and social conditions have changed profoundly over the last few decades, the ethnic groups most skilled in the cultivation and use of Palmyra palm have progressively abandoned it. Because the Turka have best preserved this knowledge, they are considered today as the specialists of this palm. Unfortunately, this seems to be linked to their economic situation, which is worse than that of their neighbors, who often see them as "backward". So it seems that the future of the plant in Burkina Faso rests today on Turka. However, a few Karaboro, attached to the plant for its cultural and symbolic value, are looking for types of use compatible with the modern context. According to Bayton et al. (2006) and data from the National Forest Inventory (IFN, 2016), *B. akeassii* is nevertheless the most common and abundant palm species in western Burkina Faso. In the commune of Wolonkoto, *B. akeassii* is still observed over large areas and in high densities. Furthermore, the health status of the populations of this species in Wolokonto is satisfactory. Indeed, while signs of sap and leaf exploitation are visible, those of attacks attributable to pathogens are very rare (Cassou, 1996; Béné, 2022). According to Cassou et al. (1997), petiole harvesting is a more intensive and visible activity at Wolonkoto than sap extraction in palm groves, which is confirmed by our own observations. However, the sex ratio favors male palms, a predominance that cannot be explained by the selective exploitation of females for palm wine, since all individuals, regardless of sex, are used. Such a structure favoring males can be found both in natural populations of *B. aethiopum* in Côte d'Ivoire (Barot et al., 1999) and in other *B. akeassii* palm stands in south-west Burkina Faso (Zon et al., 2021). This result contrasts with the observations of Thione (2000) in a natural population of *B. aethiopum* in Senegal. At Wolonkoto, Palmyra palms have been observed in a variety of habitats such as watercourses and areas set aside for market gardening. This highlights their ability to reproduce and disperse, as well as a residual interest on the part of local residents. The average density recorded in Wolonkoto (166 adult palms·ha^{-1}) is comparable to that reported in the same commune (155 adult palms·ha^{-1}) by Cassou a few decades earlier (1996). These values are higher than those (49 plants·ha^{-1}) reported by Yaméogo et al. (2016) in agroforestry

parks in central-western Burkina Faso. Overall, the situation of this species at Wolonkoto appears thus to guarantee the reproductive success and long-term survival of the species. Nevertheless, rapid population growth and the expansion of residential areas are putting increasing pressure on land and resource use, including palm populations. Such a vigorous regeneration may subsequently be hindered by human activities. This is clearly demonstrated by research in Burkina Faso (Savadogo et al., 2022; Zoma et al., 2022) and elsewhere in West Africa (Adamou et al., 2023; Cobelli et al., 2023). With a population of 2,694 inhabitants in 2006, of which over 55% are women (INSD, 2008), the commune of Wolonkoto now has 4,142 inhabitants (INSD, 2020). Indeed, over the course of a decade, the population of the commune has nearly doubled. Transitions of this magnitude generally have significant consequences on traditional structures (Fayama & Soulama, 2022) as well as land use patterns (Augusseau et al., 2006; Audouin & Gazull, 2014). Studies conducted in southern Burkina Faso (Caillault et al., 2012; Béné & Fournier, 2014) mention the rapid transformation of natural environments and agricultural spaces into residential. This trend inevitably leads to fragmentation and partial or even total deterioration of palm stands.

The abandonment of traditional practices for using this plant, revealed by surveys, has greatly contributed to the decline in the economic and social profitability of palm products in Wolonkoto. At the same time, the knowledge and techniques acquired over time have been eroded. This change is partly attributable to the spread of Islam, which resulted in a growing disinterest in palm wine, one of the flagship products of *B. akeassii*. This phenomenon has been documented for a long time in the region (Koné, 1958). In another cultural area (Benin) and in relation to other types of vegetation (sacred groves), Juhé-Beaulaton (2006) also highlights a lack of respect for traditional management rules and the abandonment or modification of associated ritual practices (see Diatta et al., 2022 for Senegal).

5. CONCLUSIONS

This study follows on from other works we have conducted in other ethnic groups in the same region. It shows that humans appear to be the primary driver of the evolution of the distribution of the *B. akeassii* palms through their cultural practices. Our results identify the Turka as the current specialists in the cultivation and use of the Palmyra palm. Their villages have some of the finest stands of palm trees in the region, and their local economy is the most dependent on the plant. It seems that the future of the plant in Burkina Faso rests today mainly on them. The news is not as good as it might seem, because their villages are lagging behind in terms of development. Turka excel in activities neglected by others and might well forget their ancestral knowledge if their situation improved. Awareness seems to be growing among the neighbors of the Turka. However, no initiative has been taken to date for the preservation of *B. akeassii* populations by local authorities whether administrative or customary. If such preservation measures were to be established, they would require a comprehensive approach encompassing social, economic, and environmental dimensions to preserve the ecological and cultural value of the species for future generations. It should be noted that *B. akeassii* has benefited from specific protection measures at the national level since the publication of decree no. 2008-016 of July 22, 2008.1762 S.F.CH. dated December 30, 1948, in Burkina Faso. In its Article 2, it specifies that the species is protected throughout the national territory: it can only be felled, uprooted or burned with the authorization of the competent forestry authorities. The story of *B. akeassii* conservation is therefore far from over in Burkina Faso!

Acknowledgements

The authors convey their appreciation to the SEP2D (Sud Expert Plants Sustainable Development) program for funding this research, and to the PALOC research unit of the IRD (French National Research Institute for Sustainable Development) for providing a platform for their work. They also extend warm thanks to the inhabitants of Wolokonto for their generous contributions, with special recognition to Mr Yaya Yé, who has demonstrated exceptional effectiveness as a field guide.

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