Distribution and local perceptions of the African oil palm tree in Kénédougou province, Burkina Faso

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Abstract

This study aims to assess local distribution and perceptions of the local oil palm tree, E*laeis guineensis* Jacq. in the Kénédougou province, where it naturally grows in Burkina Faso. Individual questionnaires were addressed to 36 men and 36 women in 6 villages about their perceptions of the species population status and local practices of its conservation. Prospection based on a network of 130 site-points was done to map the species distribution at the province's scale. The distribution map of *E. guineensis* showed that the species is more frequent to the South of the province where the hydrographic network is denser than in the northern part. Ethnobotanical survey showed that the perceptions of stand status of *E. guineensis* are influenced by age and ethnic groups. In general, oil palm is perceived as an ordinary plant and few actions are undertaken to conserve the species at local scale. Local people mostly cited the weakness of rainfall and the over-harvesting as main causes of the regression of the oil palm populations in Kénédougou province. Further investigations are needed to elucidate the impact of climate and human exploitation pressure on oil palm populations.

Keywords: *Elaeis guineensis*, distribution, local knowledge semi-arid area, Burkina Faso.

Distribution et perceptions locales du palmier à huile, *Elaeis guineensis* Jacq. dans la province du Kénédougou, Burkina Faso

Résumé

L'objectif de cette étude est d'évaluer la distribution et les perceptions locales du palmier à huile, *Elaeis guineensis* Jacq. dans la province du Kénédougou où l'espèce pousse naturellement au Burkina Faso. Des questionnaires individuels ont été administrés à 36 hommes et 36 femmes dans 6 villages concernant les perceptions locales de l'état des populations de l'espèce et des pratiques locales de sa conservation. Une prospection basée sur 130 points géoréférencés a permis de cartographier la distribution de l'espèce à l'échelle de la province. La carte de distribution de *Elaeis guineensis* a montré que l'espèce est plus fréquente au sud de la province où le réseau hydrographique est plus dense que dans la partie nord. Les enquêtes ethnobotaniques ont montré que les perceptions de l'état des populations du palmier à huile sont influencées par l'âge et le groupe ethnique. En général, le palmier à huile est perçu comme une plante ordinaire et peu d'actions sont entreprises pour sa conservation à l'échelle locale. La population locale a cité la faiblesse de la pluviométrie et la surexploitation humaine comme principales causes de la régression des populations de palmier à huile dans la province du Kénédougou. Les futurs travaux devront expliciter les impacts du climat et de l'exploitation humaine sur le palmier à huile.

Mots-clés : *Elaeis guineensis*, distribution, savoirs locaux, région semi-aride, Burkina Faso.

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Introduction

Success in biodiversity conservation relies on a better understanding of threats factors and the extinction risks species may face (COSIAUX *et al*., 2018). This understanding could be reached by the mean of ethnobotanical surveys (SOP *et al*., 2012 ; OUEDRAOGO *et al*., 2013 ; TIETIAMBOU *et al*., 2016), forest inventories (MOLLET *et al*., 2000; MADELAINE *et al*., 2008 ; NGOM *et al*., 2018) and occurrence recording (RHEBERGEN *et al*., 2016). Ethnobotany has been shown to be a relatively accessible and reliable source of information on vegetation dynamics (SOP *et al*., 2012). Many ethnobotanical studies in West Africa reported that palms provide a wide range of products for food, drink and medicines, material for building, weaving for local people (CHEVALIER, 1930 ; ZONGO *et al*., 2018 ; STAUFFER *et al*., 2017 ; YAMÉOGO *et al*. 2008 ; CAMARA *et al*., 2017).

The African oil palm tree, *Elaeis guineensis* Jacq., is one of the most economically valuable member of Palmae (STAUFFER *et al*., 2014) which occurs naturally in humid areas and riparian forests in West Africa (ARBONNIER, 2009). In Burkina Faso, especially in Kénédougou province, *Elaeis guineensis* is one of the most preferred oil crops by rural people (TIETIAMBOU *et al*., 2016 ; OUEDRAOGO *et al*., 2013). The trunks and leaves of the species are used for house construction and the fruits are used for cooking (ARBONNIER, 2009). Oil is extracted from the fruits pulp and seeds for many purposes like food, traditional medicine and cosmetics (OUEDRAOGO *et al*., 2013 ; TIETIAMBOU *et al*., 2016). The overharvesting of the species organs in addition to habitat loss have resulted in a steep decrease of the species' populations. Investigations on local ecological knowledge and spatial distribution could provide relevant information for understanding the species' conservation status in order to build sustainable management plans.

Eleais guineensis is a well-known species for its oil potentials (OUEDRAOGO *et al*., 2013) and for other purposes (CAMARA *et al*., 2017). Even though *Eleais guineensis* is cultivated in many regions across the world, wild stands of the species are still harvested making them locally threatened (MOLLET *et al*., 2000; NGOM et al., 2018). However, oil palm tree plays a key ecological role by hosting numerous woody species in their populations (NGOM *et al*., 2018) and contributing to mitigate climate change by sequestering high rate of carbon (LAMADE & BOUILLET, 2005). Then, it is crucial to gather information on wild stands of *Eleais guineensis* particularly in vulnerable semi-arid areas like Burkina Faso. Previous studies have proved that both water deficit and local harvesting influence the population structure of *Elaeis guineensis* (MOLLET *et al*., 2000 ; RHEBERGEN *et al*., 2016 ; NGOM *et al*., 2018). Nevertheless, assessing the local distribution and perceptions on species uses, importance and conservation status are important to plan better sustainable management. Most studies showed that socio-professional and socio-cultural factors including age, gender, and ethnicity influence species uses and perceptions (SALAKO *et al*., 2018 ; SOP *et al*., 2012 ; DE CALAWE *et al*., 2009). The objectives of this study are: (i) to assess the local distribution pattern of *E. guineensis* in the Kénédougou province, (ii) to understand the influence of socio-cultural factors on local perceptions of *E. guineensis* and (iii) to identify local practices of conservation adopted to protect the species in Kénédougou province.

I. Material and methods

1.1. Study area

The study was carried out in the Kénédougou province (9°30'-12°00' N and 2°50'-5°30' W) located to the West of Burkina Faso (figure 1). The Kénédougou province belongs to the Sudanian climatic zone of Burkina Faso with 900-1100 mm range of mean annual rainfall and two contrasting seasons (DIPAMA, 2010 ; FONTES & GUINKO, 1995). The rainy season lasts 6-7 months on average, from May or June to November with 90 rainy days (OUEDRAOGO *et al*., 2013). The major ethnic groups are Senoufo, Toussian, Bolon, and Siamou. The main economic activity is farming, but local people harvest natural forest resources for their livelihood.

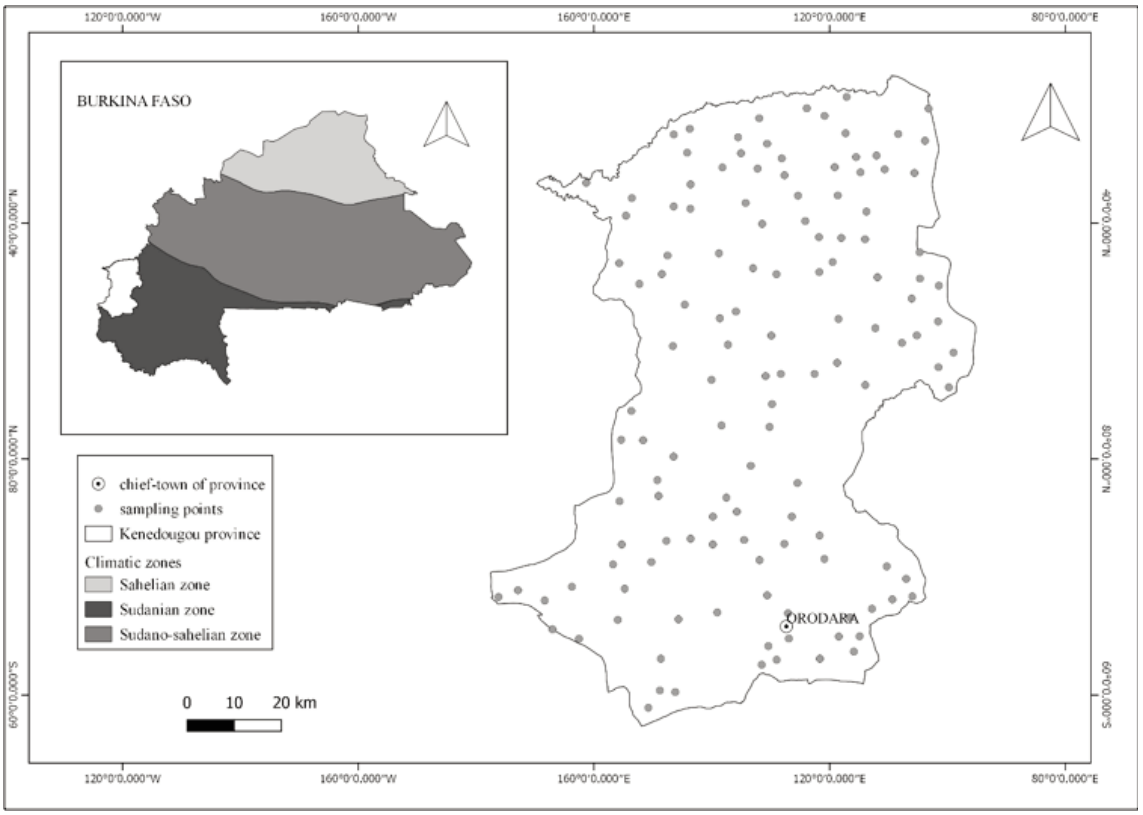

Figure 1. Study area with sampling points.

1.2. Study species

The African oil palm, *Elaeis guineensis*, is a pleonanthic and monocious palm with a solitary stem and pinnate leaves (STAUFFER *et al*., 2014). The stem is up to 30 m tall and 40-50 cm in diameter, almost always straight and densely covered by leaf sheath remnants. The leaves are up to 50. The leaves could reach 8 m of long, frequently with an arched rachis and more or less regularly inserted, and clustered leaflets. The inflorescences and infructescences are tightly compressed by the surrounding leaf sheaths. The fruits are 3-4 cm long, 2-3 cm in diameter, topped by a solid stigmatic remain (STAUFFER *et al*., 2014).

1.3. Sampling and data collection

We prospected 130 points in Kénédougou province (figure 1). These points were obtained from a systematic sampling strategy by a grid point with 3 km distance from one to another. This prospection allowed us to record 110 occurrence points of oil palm tree. Both individual and population positions were recorded with a GPS in order to assess the distribution of the species at the province scale.

An ethnobotanical survey was conducted in six villages namely Fon, Nidara, Sikorla, Sindo, Tin and Wolonkoto in Kénédougou 's province. The selection of these villages was based on the presence of wild population of *E. guineenis*. In each selected village, six men and six women were interviewed randomly irrespective of age and profession (OUEDRAOGO *et al*., 2013). Semi-structured questionnaires were addressed to a total of 72 informants in order to collect their perceptions and practices of conservation of *E. guineensis*. The information collected concerned the socio-cultural characteristics of each informant and their local perceptions of importance, population's evolution and status and traditional practices of conservation of *E. guineensis*.

1.4. Data analysis

The occurrence points of oil palm were projected on Kénédougou province map and superimposed to hydrographic networks and isohyets lines. We used QGIS 3.8 to map the species distribution at province's scale.

The relative frequency of citation of each perception/practice was calculated as the ratio of the informants' number (n) related to a specific perception/practice to the total number (N) of informants. The Chi test was performed to assess the influence of socio-cultural factors on diverse perceptions of oil palm. All statistical analyses were performed with R 3.6.1 software (R CORE TEAM, 2019).

II. Results

2.1. Distribution of *Elaeis guineensis* in Kénédougou province

The oil palm tree had an irregular distribution in the Kénédougou province area. The distribution of *E. guineensis* showed that the species is more frequent to the South of the province where hydrographic networks is denser and rainfall is higher than in the northern part (figure 2).

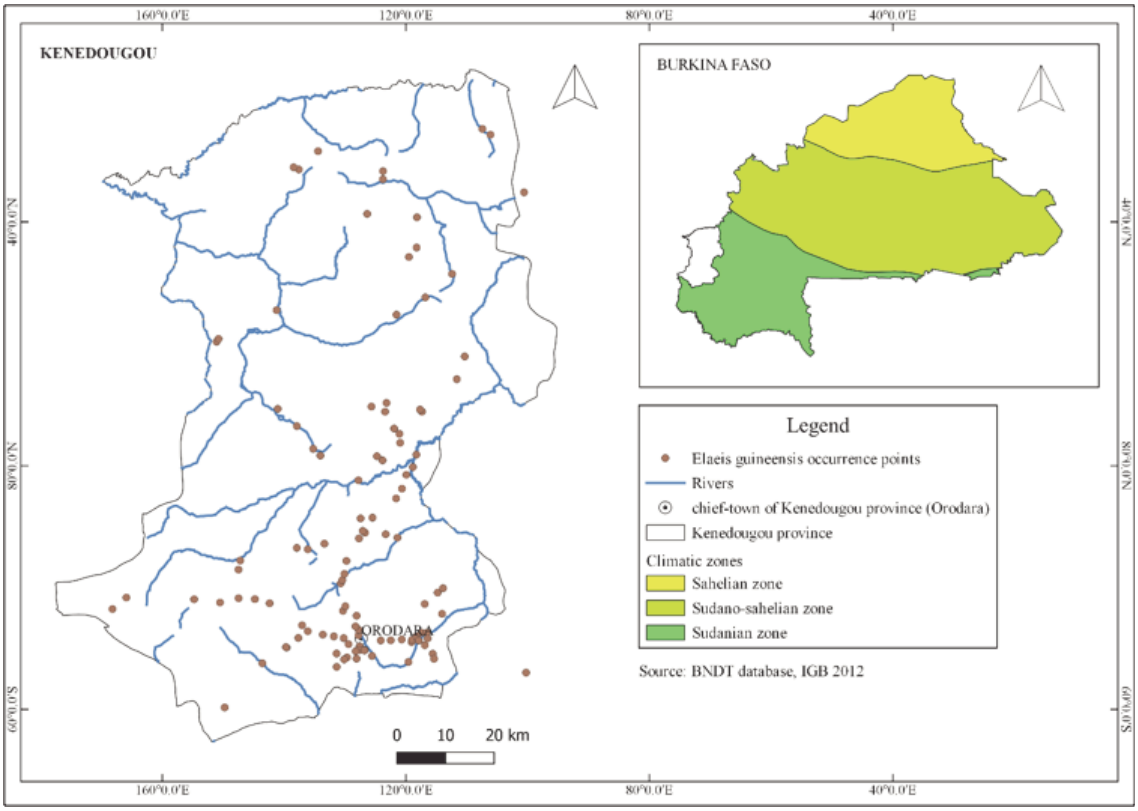

Figure 2: Distribution map of oil palm tree in Kénédougou province

2.2. Profile of informants

The majority of informants was adult and belonged either to Senoufo or to Siamou ethnic groups. The others concerned one Dioula, one Toussian and one Bobo all women who are married in these villages (Table 1). All men were famers and women householders.

Table 1: Socio-cultural characteristics of informants

Factors	Modalities	Number of informants
Gender	Male	36
	Female	36
Ethnic group	Senoufo	34
	Siamou	35
	Others	3
Age	Young (age<30 years)	13
	Adult (30 ≤ age<60 years)	47
	Old (age ≥ 60 years)	12

2.3. Influence of socio-cultural factors on perceptions of *E. guineensis*

From our ethnobotanical data, the bulk of informants (90%) perceives *E. guineensis* as common plant without any particular economic or cultural value (figure 3). There is no significant relationship between socio-cultural factors and perceptions of importance and status (p-value > 0.05 ; table 2). Nevertheless, age and ethnic group have influence on perceptions of distribution range and density evolution of oil palm in Kénédougou (p-value < 0.05 ; table 2). Indeed, adult (57.44%) and old people (66.66%) thought that density of oil palm tree decreased, but young people (76.92%) perceived an increase in density of the species (figure 4). In term of extend also, 63.82% of adult and 66.66% of old people perceive the decrease of oil palm while 76.92% of young people thought that distribution range of oil palm populations are increasing (figure 5). As far as the ethnic groups are concerned, 67.65% and 70.58% of Senoufo perceived respectively the decrease of density and extend of the species, but the Siamou believed that density (65.71%) and distribution range (57.14%) are increasing (figures 4;5). The perception of the status of oil palm tree was not influenced by any socio-cultural factor (table 2). Indeed, most of surveyed people (61%) thought that palm oil species is not threatened in Kénédougou province.

Table 2: Influence of socio-cultural factors on perceptions of *Eleais guineensis* Jacq. in Kénédougou.

Perceptions	Factors	x-squared	df	p-value
Importance of *E. guineensis*	Age	5.3322	4	0.2549
	Gender	1.4718	2	0.4791
	Ethnic group	3.9863	2	0.1363
Distribution range evolution of *E. guineensis*	Age	8.7832	2	0.01238*
	Gender	1.2689	1	0.26
	Ethnic group	6.3983	1	0.01142*
Density evolution of *E. guineensis*	Age	6.4356	2	0.04004*
	Gender	1.4391	1	0.2303
	Ethnic group	8.0201	1	0.004626*
Status of *E. guineensis*	Age	0.33915	2	0.844
	Gender	1.5297	1	0.2162
	Ethnic group	2.9412e-31	1	1

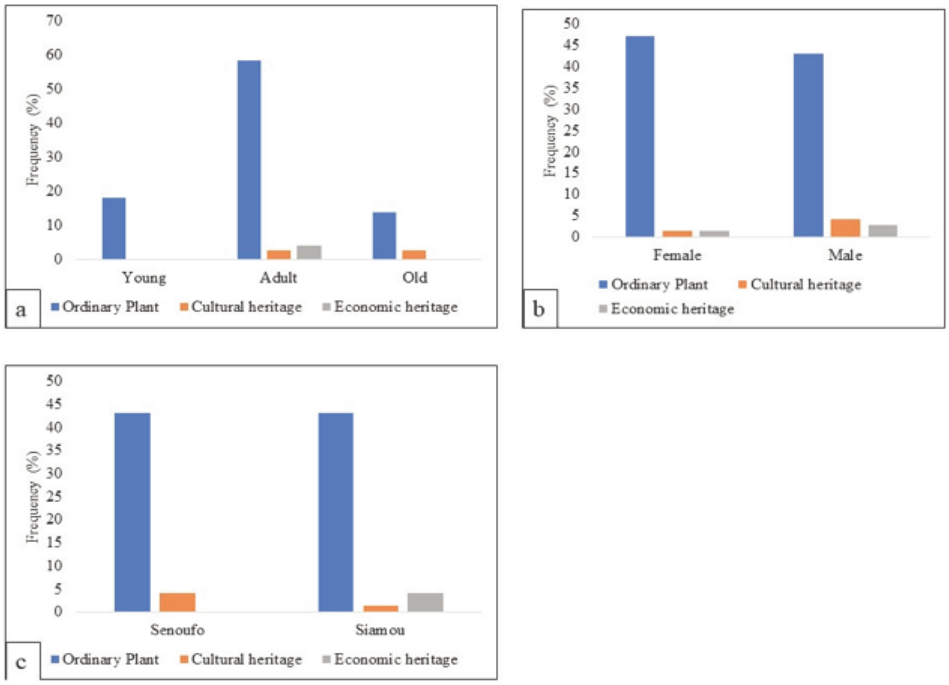

Figure 3: Perception of importance of oil palm species according to socio-cultural factors in Kénédougou.

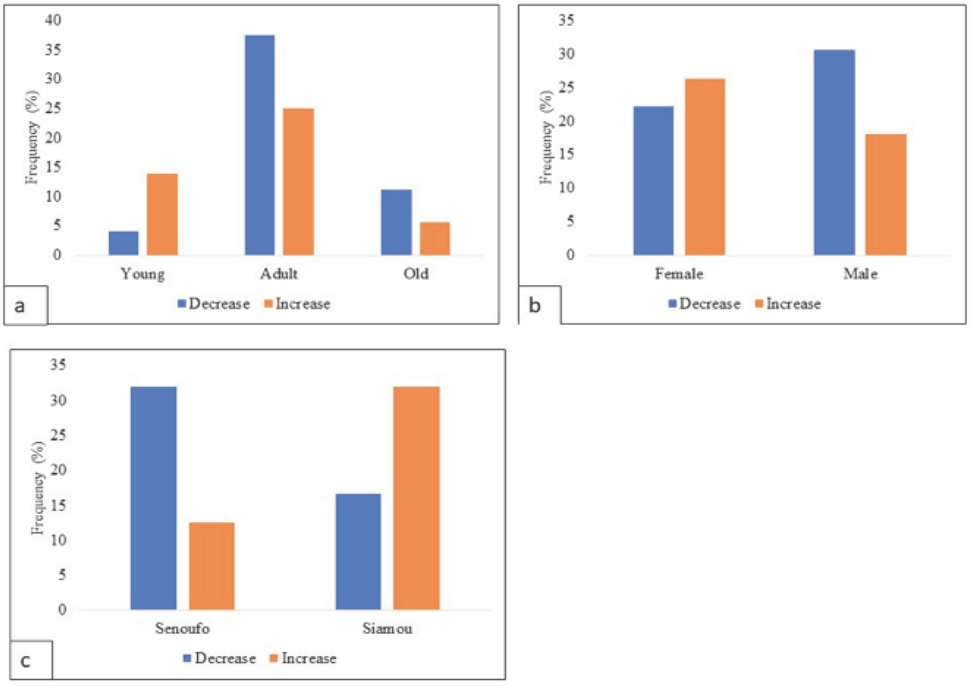

Figure 4: Perception of density evolution of *Elaeis guineensis* according to socio-cultural factors in Kénédougou province.

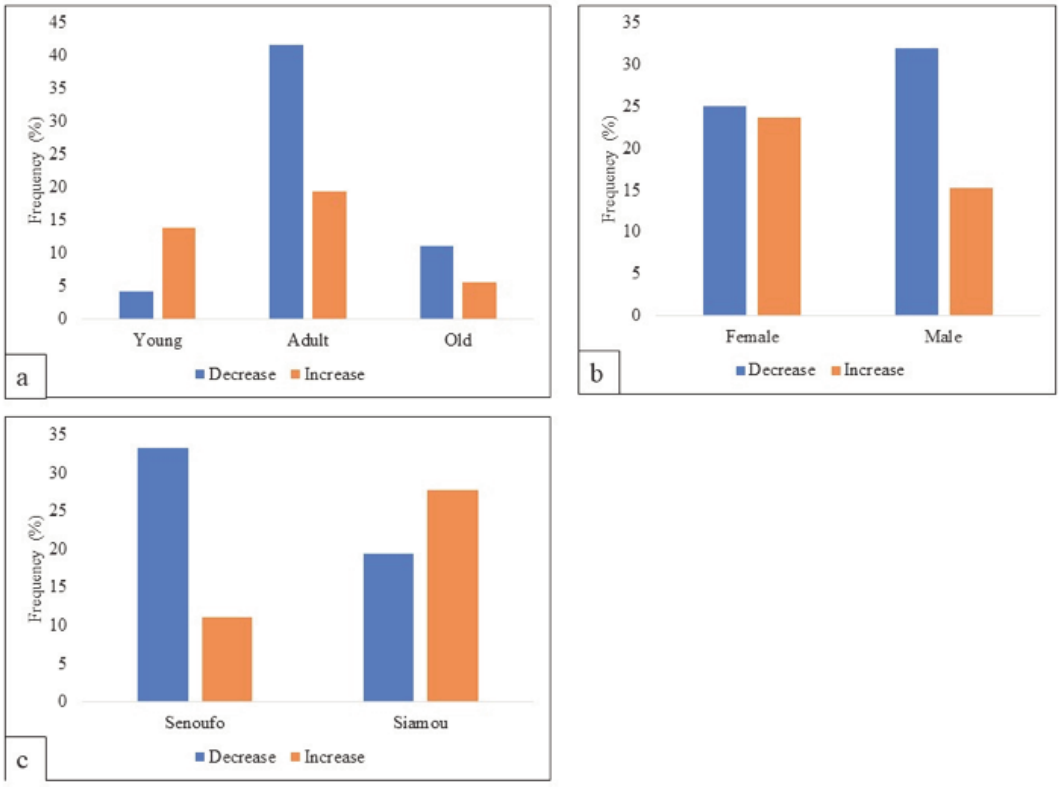

Figure 5: Perception of distribution range evolution of *Elaeis guineensis* according to socio-cultural factors in Kénédougou province.

2.4. Threats and local practices of conservation of *E. guineensis*

Three main threats were cited by local people as challenges for the conservation of *E. guineensis* namely weakness of rainfall, over-exploitation of oil palm products and farming. The weakness of rainfall is the most cited threat followed by over-exploitation (figure 6). However, local people do not act in conserving oil palm. Indeed, the bulk of interviewees (63%) do not undertake any conservative actions, and only 2% are making plantation (figure 7).

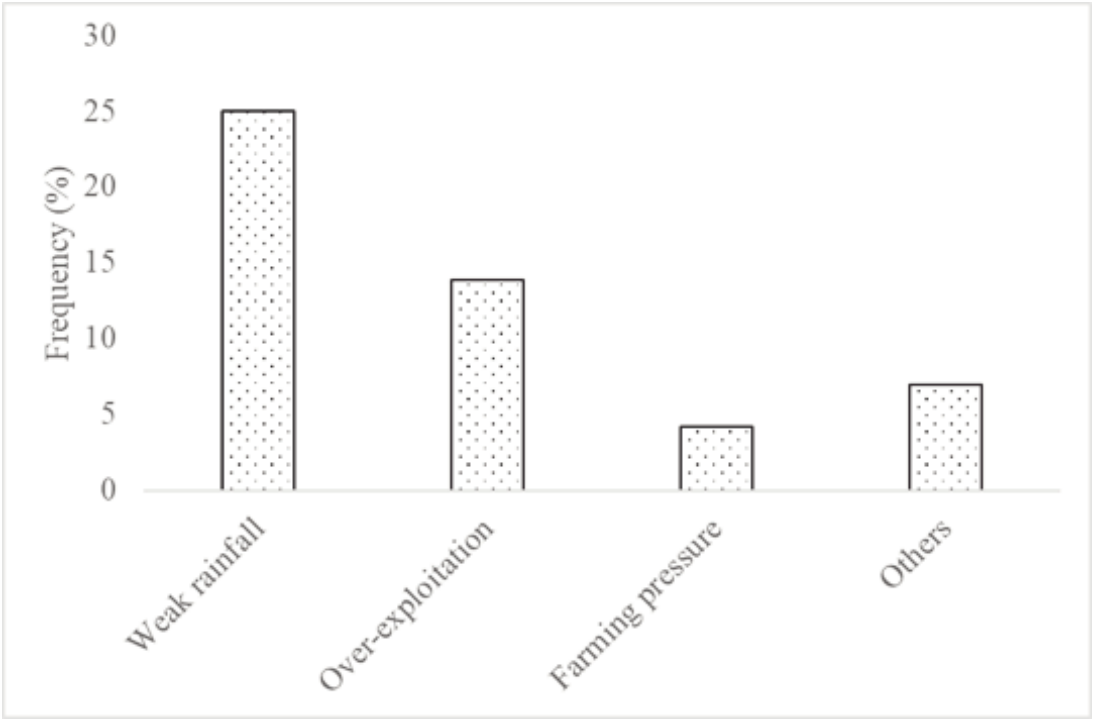

Figure 6: Threats cited on oil palm in Kénédougou province.

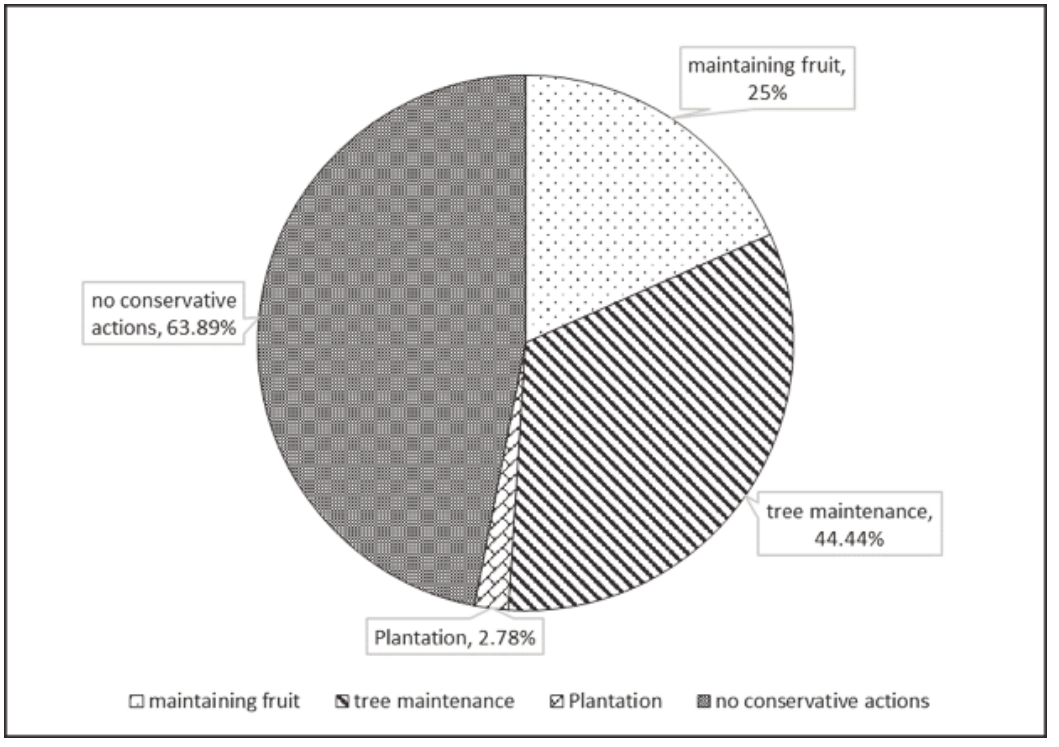

Figure 7: Traditional conservation actions of oil palm tree in Kénédougou province.

III. Discussion

3.1. Distribution of oil palm in Kénédougou province

The distribution pattern of oil palm tree in Kénédougou province is mainly driven by water availability. This is in line with RHEBERGEN *et al*. (2016) who identified suitable climatic conditions (annual average water deficit <400 mm) for oil palm in rainforests and semi-deciduous forest zones with higher rainfall in southern Ghana. DIPAMA (2010) reminds that climate change causes isohyets lines migration from North to South of Burkina Faso, increasing the water scarcity in the northern parts. The Kénédougou province is concerned by these changes. To the North of the province, oil palm individuals were met only in waterfront. In addition, the culture of cotton makes a great pressure on oil palm populations in the northern part, challenging its conservation. Similar observation was made in Guinea (MADELAINE *et al*., 2008).

3.2. Influence of socio-cultural factors on perceptions of importance and evolution of oil palm

Our survey showed that oil palm tree is considered as a common ordinary tree in Kénédougou province. No particular cultural usage of *E guineensis* was reported in Kénédougou province neither among Senoufo nor Siamou ethnic groups (OUEDRAOGO *et al*., 2013 ; TIETIAMBOU *et al*., 2016). However, some ritual uses of the species are identified in other region in Africa (GRUCA *et al*., 2014). In Senegal, *E. guineensis* contributes to local income by commercialization of sap and oil (CAMARA *et al*., 2017). In addition, palm oil is used in traditional religious practices such as voodoo, particularly among the Ewe ethnic groups of south-eastern Ghana, Togo and Benin (OUATTARA *et al*., 2015). In Kénédougou province, oil from *E. guineensis* is used for trade and self-consumption (TIETIAMBOU *et al*., 2016), but local people do not perceive any particular economic or cultural importance of oil palm trees. That could be explained by the fact that the bulk of the interviewed people has a primary economic activity which is farming.

Moreover, our data supports the general trend of age and ethnicity influence on the perceptions of evolution of *E. guineensis*. Difference of perceptions according to age was reported by some authors (SALAKO *et al*., 2018), while other ones (DE CALAWE *et al*., 2009) do not find any influence of age on perceptions. It is widely accepted that old people have better knowledge on plants than young people due to the fact that they have a long time to accumulate knowledge and observe dynamics through a long time. The difference of perceptions between ethnic groups was observed in many studies (DE CALAWE *et al*., 2009 ; OUEDRAOGO *et al*., 2013). Our data sustains that Senoufo noticed the decrease of density and distribution range of oil palm while Siamou observed the opposite trend. These differences may be advocated by the effect of sites on the perception of each ethnic groups. The site effect on local perceptions has been argued by GAOUE and TICKTIN (2009). Similar knowledge of the species among socio-cultural groups could indicate a high abundance of the species (SALAKO *et al*., 2018). So far, we can assume that *E. guineensis* possesses low abundance in Kénédougou province.

However, there is no influence of gender on the perceptions of oil palm groves. This result is similar to the one found by SOP *et al*. (2012) in the Sahelian zone of Burkina Faso. The taking on duties traditionally undertaken by men could explain the homogenization of plant knowledge between males and females (SOP *et al*., 2012). In Kénédougou province, both men and

women harvest natural resources for many and sometimes different purposes. But their knowledge of oil palm populations' evolution remains similar due to the fact that they share the same natural environment. In general, knowledge differ between gender as far as uses are concerned, with women holding higher knowledge especially on medicinal plants (GAOUE *et al*., 2017).

3.2. Threats and conservation of oil palm

Most of surveyed people (61%) thought that oil palm species is not threatened in this area, but they cited many pressures with potential to threaten oil palm tree in Kénédougou province including the weakness of rainfall and harvesting of palm organs. The over-harvesting can compromise the conservation of oil palm species is this province. Indeed, oil palm tree is exploited for many purposes including food, cosmetic, medicine, basketry and handicraft. OUEDRAOGO *et al*. (2013) and TIETIAMBOU *et al*. (2016) identified other native promising oil trees, the exploitation could contribute to decrease the pressure on oil palm tree and shea butter. However, oil palm tree is still preferred in Kénédougou province (TIETIAMBOU *et al*., 2016). The exploitation of organs including sap tapping threatened the species in Cote d'Ivoire (MOLLET *et al*., 2000), but these harvesting technics seems rare in Burkina Faso where *Borassus akeassii* Bayt. Ouedr. & Guinko is the main tapped palm. The sap tapping of *Borassus akeassii* is made by a sustainable technic which maintain the tree alive in opposite to others technic elsewhere. In Senegal, NGOM *et al*. (2018) argued that oil palm parklands are experiencing anthropic pressure challenging their conservation.

Conclusion

In the Kénédougou province of Burkina Faso, the native oil palm species, *Elaeis guineensis*, is more frequent in the South of province where water courses network is denser than in the northern part. Age and ethnic groups influence local perceptions of the palm. In contrary, the perception of importance and status of the species are not influenced by any socio-cultural factors. Some local people are aware that oil palm is threatened by the weakness of rainfall and over-harvesting but they are not embarked in any conservative strategy. Future investigations should be focused on the impact of climate and exploitation on the oil palm for better conservation planning.

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