



Les perceptions de L'influence du Genre et du Groupe Social de la Vulnérabilité de *Vitellaria paradoxa* et de *Parkia biglobosa* aux Menaces au Burkina

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Résumé

L'objectif de cette étude est d'examiner les connaissances et les perceptions des populations locales en fonction du sexe et de l'origine ethnique sur les facteurs qui constituent une menace sur les deux espèces que sont *Vitellaria paradoxa* et de *Parkia biglobosa* et d'en déterminer leurs causes. Les données ont été collectées à travers des entretiens de groupe (focus group discussion) et cela en tenant compte du genre et des groupes ethniques présents dans chaque localité. Au total 15 types de menaces regroupés en 3 facteurs : écologique, climatique et anthropique ont été identifiés à Bana Bobo, Bana Lamogoya et Yarci par genre et par les différents groupes ethniques. Les femmes ont le plus cité deux (2) des trois (3) principaux facteurs de menaces que sont : les plantes parasites et les attaques parasitaires (insectes et vers). Les Peulh sont ceux qui ont le plus cité les 3 principaux facteurs de menaces identifiés. Dans l'ensemble des sites, *Vitellaria paradoxa* se révèle être l'espèce la plus vulnérable aux menaces comparativement à *Parkia biglobosa*. L'action de l'homme constitue la cause des menaces anthropiques. Les conséquences qui résultent de l'ensemble des menaces sont surtout la faible productivité et dans le pire des cas, la mortalité des espèces.

Mots-clés: Menaces, *Parkia biglobosa*, *Vitellaria paradoxa*, genre, ethnicité

Gender and Social Group Influence Perceptions on Vulnerability of *Vitellaria paradoxa* and *Parkia biglobosa* to Threats in Burkina Faso

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Abstract

The objective of this study is to investigate knowledge and perception of local populations based on gender and ethnicity about factors that constitute a threat to the two species that are *Vitellaria paradoxa* and *Parkia biglobosa*, and to determine their causes. The data were collected through focus group discussions, taking into account the gender and ethnic groups that are present in each locality. A total of 15 types of threats, grouped into three factors: ecological, climatic and anthropic, were identified in Bana Bobo, Bana Lamogoya and Yarci by gender and by the different ethnic groups. Women cited two (2) of the three (3) main threat factors that are: parasitic plants and parasitic attacks (insects and worms). The Fulani were the ones who cited the 3 main threat factors identified. In all the study sites, *Vitellaria paradoxa* is the species vulnerable to threats than *Parkia biglobosa*. The action of man constitutes the cause of the anthropic threats. The consequences that result from all the threats are mainly the low productivity and in the worst case, the mortality of the species.

Keywords: Threats, *Parkia biglobosa*, *Vitellaria paradoxa*, gender, ethnicity

1. Introduction

Non-timber forest products (NTFPs) contribute on a large scale to the improvement of people's living and livelihood conditions. For several decades, fruit species have been important sources of income for the local populations who exploit them (Loubelo, 2012). In Burkina Faso, *Vitellaria paradoxa* (shea) and *Parkia biglobosa* locust bean tree (nééré) are the two (2) most important NTFPs in Burkina Faso. These two (2) species are involved in satisfying household's need through food, generating income through the marketing of products from these species, medicinal uses and other ecosystem services. The shea and nééré tree sectors are those that concentrate the most national actors with 48% and 28% of producers/gatherers and

processors respectively (DGEEVCC, 2017). This exposes these two species to continuous overexploitation.

Over the years, environmental changes are perceptible in the ecosystems and constitute serious threats to the forest species such as *Vitellaria paradoxa* and *Parkia biglobosa*. According to PANA (2006), the adverse effects of climatic hazards cause the fragility of ecosystems and the disappearance of many species. With the phenomenon of desertification that is growing, the issue of ecological health is a priority for the various programs to combat the destruction of plant resources throughout the territory of Burkina Faso. Other ecological and biological factors threaten the survival and health of plants at an accelerated rate, just like the former. A threat can be defined as a sign or indication that something dangerous or harmful is about to happen to woody species.

In Burkina Faso, there are few studies on the analysis of the vulnerability of woody species to threats, whose contribution to the needs of local populations is no longer in question. The study of local knowledge of threat factors is necessary to capitalize on the perceptions of users male and female, in all their ethnic diversity and their traditional knowledge in the management strategies of natural woody resources. Local perception is an indispensable approach for the study of threats to shea and local beans tree. In addition, it ensures local acceptance of perspectives and strategies to combat these threats. Indeed, understanding the knowledge systems and actual constraints affecting these two species can help identify efficient solutions for the development of control programs to substantially increase local incomes and conserve biodiversity. The objective of this study is to investigate how knowledge and perception of local populations about the threat factors that weigh on the *Vitellaria paradoxa* and *Parkia biglobosa* may vary according respondents' gender and ethnicity. As Ingold 2012 attests, "the perception of the environment is a cultural construction of nature, or the superimposition of layers of 'emic' meanings on an autonomous 'etic' reality. This means that this perception could vary according to the gender of the respondent (female or male) on the one hand and on the other hand, from one ethnic group to another. The study is therefore a contribution to the establishment of local knowledge on the types of threats affecting the two species.

2. Materials and methods

2.1 Description and characterization of the study site

The survey took place between July and December 2015 in two (2) villages that are: Bana and Yarci, located respectively in the provinces of Houet and Passoré in Burkina Faso (**Fig. 1**).

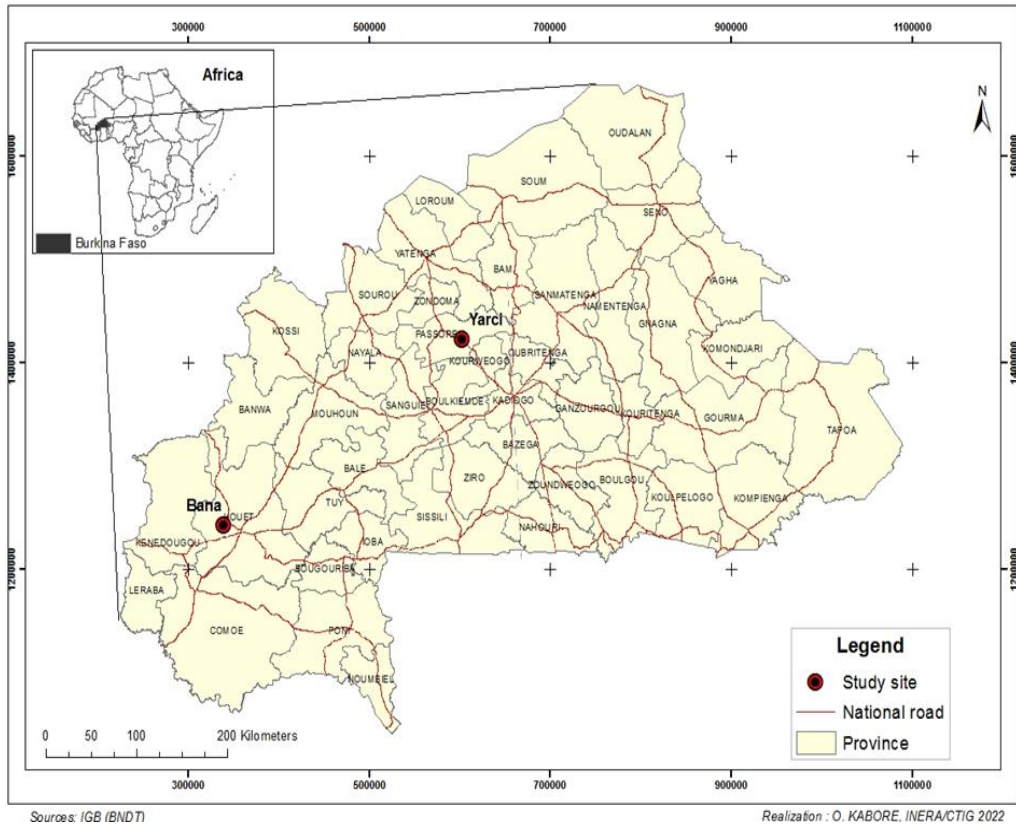


Figure 1. Location map of the study villages

The village of Yarci is located in the department of Arbollé in Passoré province in the northern region of Burkina Faso. It is located at 2.5 km northwest of Arbollé, the chief town of the department. Bana is located in the department of Bobo-Dioulasso, province of Houet, administrative region of Hauts Bassins, in the southern part of the country. The village of Bana is located about thirty kilometers from Bobo-Dioulasso, the second largest city in Burkina Faso. The village of Bana is divided into two (2) parts: Bana-Bobo and Bana Lamogoya, separated from each other by a river which makes these 2 parts considered by the inhabitants as 2 different villages. The southern part of the river towards Bobo is called Bana-Bobo and belongs to the commune of Bobo. The western part of the river is called Bana-Lamogoya and belongs to the commune of Karangasso-Sambla.

The local climate is tropical dry with a longer of dry season from October to May and a rainy season from June to September. The village of Bana is located in the transition zone between Sudan and the Sahel, in an area that receives an average annual rainfall of 900 to 1200 mm. Temperatures range from a low of 19.5°C during the cool period from November to February to a high of 36.5°C during the hot period of March

and April (MATD 2007). The landscape is characterized by shrub-savanna gallery forests. The dominant tree species are *Vitellaria paradoxa*, *Khaya senegalensis*, *Azelia africana*, *Parkia biglobosa*, *Lannea microcarpa*, *Piliostigma thonningii*, *Detarium microcarpum*, *Mitragyna inermis* and *Sclerocarya birrea* (MATD 2007). In Yarci, a locality located in the northern part of the country, and benefiting from little rainfall compared to Bana, the vegetation is essentially composed of tree and shrub steppes. In all the villages, agriculture and livestock farming are the main means of subsistence, followed by trade. The population of Yarci is estimated at 824 inhabitants, including 356 men and 468 women (RGPH, 2006). It is made up entirely of Mossi ethnic groups.

The population of Bana is estimated at 756 inhabitants, including 373 men and 383 women (RGPH, 2006). The southern part (Bana Bobo) is made up of Bobo, Mossi and Fulani ethnic groups. Three religions are found in Bana Bobo: Islam (Fulani and Mossi), Catholicism (Bobo and Mossi). However, the Bobo remain anchored in traditional religion (animism) where customary rites such as the wearing of masks and the observation of sacrifices remain common practices. In Bana Bobo, traditional political power is organized around the following three figures: the village chief, the land chief, and the bush chief, all of whom are of the indigenous Bobo ethnic group. These three figures are heavily involved in the management of natural resources, including trees. The land chief is responsible for the management of village lands and traditional sacrifices/rites for the fetish. In Bana Lamogoya (western part), there are essentially two ethnic groups: the Sambla and the Mossi, both of whom are predominantly Muslim. However, like the Bobo, the Sambla also remain rooted in animism (traditional religion). There are different status of land and this leads to different access rights according to gender and residence status.

2.2. Data Collection

The survey involved groups of women and men from each of the ethnic groups present in the two localities. Thus, in Yarci, where the population is made up solely of Mossi ethnic groups, two (2) groups were formed: the group of women and the group of Mossi men. In Bana Lamogoya, where Sambla and Mossi cohabit, four (4) groups were formed, distributed as follows: the Sambla men's group, the Sambla women's group, the Mossi men's group and the Mossi women's group. Finally, in Bana Bobo, where Bobo and Fulani live together, 4 groups were formed, composed as follows: the Bobo men's group, the Bobo women's group, the Fulani men's group and the Fulani women's group. In total, 10 groups were formed, 5 made up of women and 5 made up of men. Each focus group included at least 10 adult participants aged at least forty (40) years each

2.3 Data Analysis

Primary survey data were analyzed using Excel and Statistical Package for Social Sciences software (Copyright SPSS, Windows, version 2011, Chicago, IBM, SPSS; Inc.). Graphs were made using Excel software. Analysis methods consisted of descriptive analyses and parametric tests. The descriptive analyses involved the calculation of frequencies, percentages, and means (\pm standard deviation). Dynamic cross-tabulations were developed to explain the perception of local populations of the threat factors for shea and locust bean tree. Parametric tests included Chi-square calculations, the one-factor analysis of variance (ANOVA) test and binary logistic regression.

To assess the perception of the threat factors on the two (2) species, the respondents had to give a score on a 5-point Likert scale (i.e. 5 probable categories of answers). The scales were: 1= very important, 2 =important 3= moderately important 4= unimportant, 5= not important. The values on the Likert scale were added to obtain 22 and then divided by 10 to obtain a mean score of 2.2. Then, any mean score greater than or equal to 2.2 for a given question is considered or perceived by respondents, while a mean score less than 2.2 indicates a lack or low level of perception.

3. Results and discussions

3.1 Endogenous knowledge of threats to *Vitellaria paradoxa* and *Parkia biglobosa* species

According to the respondents, parasitic plants, insect and worm attacks, and strong winds are the main threats affecting the two species (14% for each), followed by fog (10%) and vegetation or bush fires (9%).

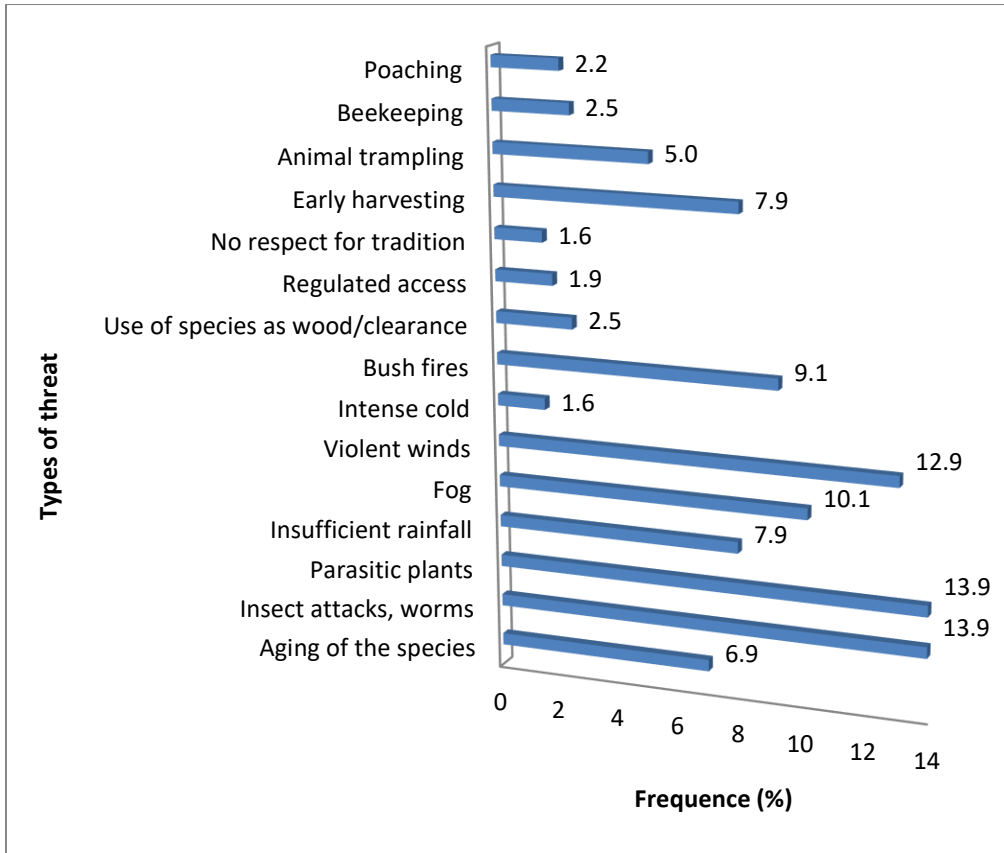


Figure 2.Threat factors cited by respondents

The threat factors cited can be classified into the following types of threats: biophysical, anthropic and climatic (**Table 1**).

Table 1. Average scores of respondents on the level of perception of threat factors

Types of threat	Factors of threat	Mean(x)	Standard deviation
Biophysical	Aging of species	1,1	1,66
	Parasite attacks	2,2*	1,49
	Species attacks	2,2*	1,38
Climatic	Insufficient rainfall	1,25	1,03
	Fog	1,6	1,15
	Strong winds	2,05*	1,26
	Intense coolness	0,25	0,79
Anthropic	Bush fires	1,45	1,12
	Use of species as wood/clearance	0,4	0,74
	Restricted access	0,3	0,95
	No respect for tradition	0,25	0,79
	Early harvesting	1,25	1,46
	Trampling of animals	0,8	1,70
	Beekeeping	0,4	1,26
	Poaching	0,35	1,11

Respondents recognize from the scores given that parasitic plants (loranthaceae and “the strangling ficus”) and pest attacks (worms, termites, etc.), for which the average for each of the two types of threats is ($\bar{x}=2.2$), and violent winds ($\bar{x}=2.05$), constitute the main threats to shea and locust bean tree. Boussim and Médah, 2009 had highlighted the attacks of loranthaceae on the shea. However, the results show a low level of perception regarding the non-respect of traditions, regulated access to the species when located in the fields, and poaching. There is a statistically significant difference between the mean scores for each threat factor ($P=0.00$, thus less than 0.05).

What about the variability in perceptions of vulnerability of *Vitellaria paradoxa* and *Parkia biglobosa* by gender and ethnic group of respondents?

3.2 Threats to *Vitellaria paradoxa* and *Parkia biglobosa* species cited by men and women

Women were the most likely to cite the main threats (worm/insect attacks, parasitic plants, and high winds) to the *Vitellaria paradoxa* and *Parkia biglobosa*. Furthermore, only women mentioned the lack of respect for tradition and regulated access to the species when they are in the fields. They also mentioned early harvesting of *Parkia biglobosa* fruit as a threat to

the specie. In contrast, men exclusively cited trampling of young plants by animals and poaching (**figure 3**).

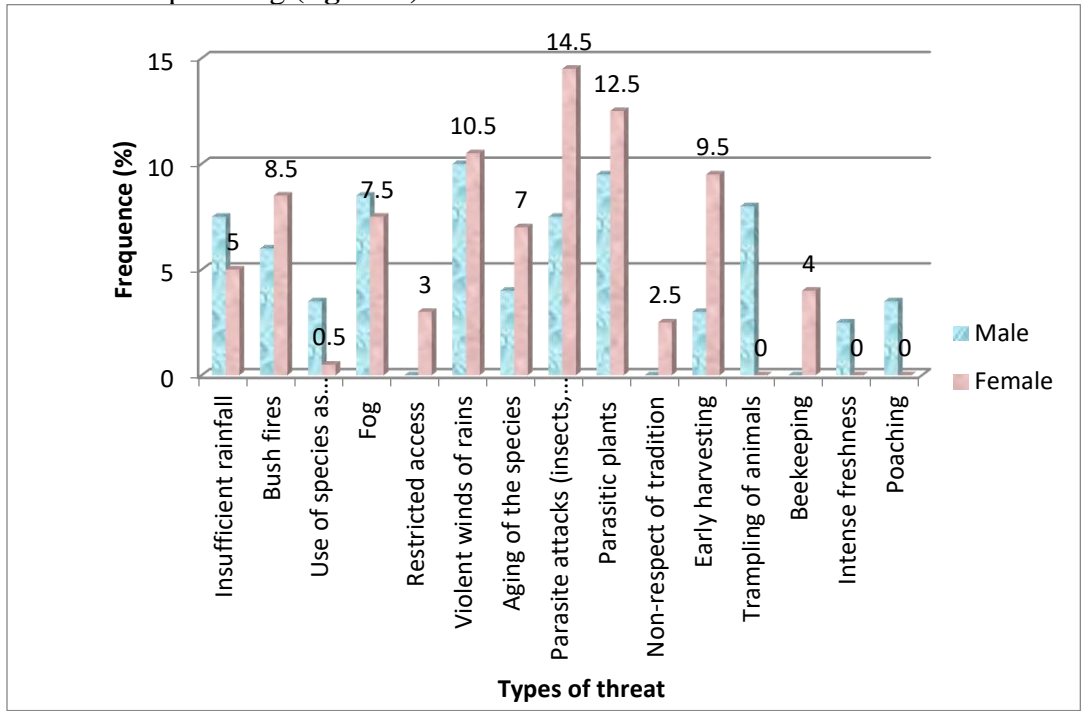


Figure 3. The main threats cited by men and women

The results indicate that there is a statistically significant relationship between gender (male or female) and knowledge of the threat factors ($p=0.0005$, thus less than 0.05). Women cited the majority of threats to the shea and *néré* species because they are the most concerned with the exploitation of these two species through the role they play in the collection and processing of these two NTFPs. Specifically, most of the threats cited either exclusively or in large part by women (such as disrespect for tradition, regulated access to species in the fields, and harvesting of immature fruits of *Parkia b.*) are those that directly involve them. Indeed, the shea trees that grow on farmland remain the exclusive property of the landowners, hence the limited access of migrant women to the species. This is in line with the findings of Pehou et al. (2020), Karambiri et al., (2017) and Elias, (2015). Augusseau et al. (2006) attest that benefits from trees growing on borrowed land are often shared between the landowner and the tenant farmer, limiting the latter's access to tree products.

Similarly, humans cited trampling of young plants by animals and poaching, which they themselves are most responsible for, as threats.

If knowledge of threats varies by gender, how might ethnicity also be an indicator of knowledge of threats to *Vitellaria paradoxa* and *Parkia biglobosa*?

3.3 Knowledge of threats to *Vitellaria paradoxa* and *Parkia biglobosa* species by ethnic group

Perceptions of threats to *Vitellaria paradoxa* (shea) and *Parkia biglobosa* (locust bean tree) vary from one ethnic group to another (**Table 2**).

Table 2. Threat factors for the two (2) species cited by the different ethnic groups

Threats	Mossi	Bobo	Sambla	Fulani
Insufficient rainfall	9,7	1,4	3,3	3,6
Bush fires	10,3	1,4	26,7	7,1
Use of species as wood/clearance	0,6	4,3	-	7,1
Fog	9,7	15,7	20,0	-
Restricted access	3,9	-	-	-
High winds	12,3	8,6	20,0	17,9
Aging of the species	9,0	5,7	-	7,1
Parasite attacks (insects, worms)	11,0	18,6	13,3	17,9
Parasitic plants	8,4	18,6	16,7	23,2
Non-respect of tradition	-	7,1	-	-
Early harvests	6,5	8,6	-	16,1
Trampling of animals	5,8	10,0	-	-
Beekeeping	5,2	-	-	-
Intense freshness	3,2	-	-	-
Poaching	4,5	-	-	-

The Fulani are the ones who most often cited the three (3) main threats: parasitic plants (23.1%), parasitic attacks (worms, insects, etc.) and violent winds (17.9% for each of the two) and early harvests (16.1%). On the other hand, threats such as bush fires (26.7%), fog and violent winds (20% for each of the two) were cited by the Sambla. Only the Bobo emphasized the lack of respect for traditions as a threat to the survival of *Vitellaria p.* and *Parkia b.* The Mossi were also the only ones to mention poaching practices, beekeeping, intense coolness, and regulation of access to the species (nééré) as threats to them. The Fulani are the ones who cited parasitic plants the most because they use loranthaceae plants to feed their animals. The native Bobo, who are the guardians of tradition, are the most concerned with respecting it, hence their dominance in citing this threat. Among the Loranthaceae, the attack of *Tapinanthus sp.* called "dundehi and tchetchehi"

by the Fulani is the most dominant. The Fulani establish a difference between the tchetchehi and the dundéhi, according to them they are two varieties of the same species defined by the size of their leaves. The *Tapinanthus* "dundehi" has large leaves while the "tchéchéhi" has small leaves. According to the producers, *Tapinanthus* grows on the vulnerable parts of the tree (holes in the trunk, intersection of branches that retain rainwater and even dust, etc.), develops over time and eventually causes the destruction of the tree. According to Boussim (1993) the average infestation rate of shea trees in Burkina Faso by *Tapinanthus* was 95%.

There is a highly significant statistical relationship between ethnic group and knowledge of threat factors for the two species ($p=0.0001$, thus, less than 0.05). However, it remains very crucial to know which of the two species is recognized as being more exposed to threats according to the respondents' perceptions.

3.4. Vulnerability assessments of shea and locust bean tree (néré) species

In general, there are similarities in the perceptions of men and women and ethnic groups regarding threats to shea and locust bean tree in the village sites.

Vitellaria paradoxa was unanimously recognized as the species most at risk from parasitic plants such as *Tapinanthus*, from host plants that grow at the foot of these species called "Welga" in Mooré or "Diatiguidjanfa gniri" in Dioula or "dundehi and tchetchehi" in Fulfulde, and from strong winds.

Vitellaria paradoxa and *Parkia biglobosa* are both known to be exposed to early harvest/immature fruit and insufficient rainfall. However, Fulani women consider *Parkia biglobosa* to be the specie most exposed to this threat.

Both shea and néré species are subject to aging. However, the shea tree was recognized as more susceptible to aging than the néré. Bobo men believe that the shea species is the most affected by the lack of respect for tradition.

Only *Parkia b.* was recognized by Fulani men as the specie that suffers the most from destruction of the branches during fruit collection.

The Mossi men consider that *Vitellaria paradoxa* is subject to exposure to bush or vegetation fires, fog, intense coolness and poaching. In contrast, Fulani women consider *Parkia biglobosa* (néré) to be the species most exposed to wildfire. According to Thiombiano et al (2016), "the shea tree shows good adaptation to recurrent wildfires because of its thick, cracked bark that protects its vital parts" (page 20).

The results in Tables 3 and 4 show the difference in perception of the vulnerability of the shea and néré species to threats, between male and female respondents and according to their ethnicity.

Table 3. Multivariate analysis of relationships between vulnerability of shea tree by gender and ethnic group

Variables		Vulnerability	P
Gender			
Female	Factors of threat	shea tree	0,006**
Male	Factors of threat	shea tree	0,008**
Male et female together	Factors of threat	shea tree	0,001**
Ethnic group		shea tree	
Bobo	Factors of threat	shea tree	0,055*
Moose	Factors of threat	shea tree	0,58
Fulani	Factors of threat	shea tree	0,396
Sambla	Factors of threat	shea tree	0,363
The set of the ethnic groups	Factors of threat	shea tree	0,001**

** : Highly significant statistical relationship

* : Almost significant relationship

Table 3 shows that there is a highly significant statistical relationship between gender and shea butter vulnerability. Indeed, the analysis gives three p-values, all of which are less than 0.05 (Female: 0.006; Male: 0.008 and Overall: 0.001). On the other hand, at the level of the ethnic group, the relationship exists only in a global manner (All together: $p = 0.001$ less than 0.05) and not at the level of all the combinations of criteria (ethnicity, threat factors and shea). However, at the level of the ethnic group, we note an almost significant relationship for the profile "Bobo, threat factors and shea butter" with a p of 0.055 close to the 0.05 threshold (see Table 3).

What about the case of the shea species?

Table 4. Multivariate analysis of the relationship between the vulnerability of locust bean tree by gender and ethnic group

Variables		Vulnerability	P
Gender			
Female	Factors of threat	Néré	0,771
Male	Factors of threat	Néré	0,441
Male and female together	Factors of threat	Néré	0,958

Ethnic group			
Bobo	Factors of threat	Néré	0,854
Moose	Factors of threat	Néré	0,879
Fulani	Factors of threat	Néré	0,299
Sambla	Factors of threat	Néré	0,363
The set of the ethnic groups	Factors of threat	Néré	0,958

Compared to shea, the vulnerability of the locust bean tree (néré) does not depend on the profiles or criteria considered. Indeed, the survey results give p-values above the 0.05 threshold for all variables (gender: 0.958 and ethnic groups: 0.958).

4. Conclusion

The characteristics of threats are diverse and multiform, according to respondents male and female in all their ethnic diversity. While some threats are occasional, temporal and circumstantial, others are recurrent, periodic, permanent and even intentional. Also, if certain threats are presented to the populations as natural phenomena not depending on the will of the Man, others on the other hand, are for them, due to the bad relations that the human beings maintain with the environment. Among all these threats, those resulting from anthropic actions remain the most violent and the most hostile to the survival of species. The harshness of the climate and the poverty of the soil already constitute a major obstacle to the development of plant species in general and shea and nééré in particular. These different threats, identified according to gender and ethnic group, add up to the extent of the destructive phenomena of species in these village ecosystems. However, the action of the inhabitants remains an important help for the species even if it does not manage to definitively eradicate these threats for which they themselves are the authors and therefore mostly responsible. Threats are the cause of the disappearance of several plant species in the Bana and Yarci ecosystems. Consciously or unconsciously, anthropic actions become the main causes of some threats, which in turn cause others. Rigorous measures must be taken by local populations, male and female together to protect and restore their environment through planting, regeneration, and other actions.

Conflicts of Interest: The author have no conflict of interest

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References:

1. Adjima, T., Edouard G, B., Louis, S., Jean Marie O., Joseph Issaka, B, Souleymane G., Ousmane Boukary D., Sibidou, S., Kimsé, O, Cyrille, K., Pascaline, C./L., Didier, Z., Soungalo, S., (2016). Etat des peuplements et du développement des technologies pour une meilleure productivité du karité au Burkina Faso. *CORAF/ INERA, Ouagadougou, 76 p.*
2. Cathérine, P., Houria, D., Barbara, V., Marlène, E. (2020) *Intersecting and dynamic gender rights to nééré, a food tree species in Burkina Faso.* Journal of Rural Studies In Press Available from: https://www.researchgate.net/publication/339922911_Intersecting_and_dynamic_gender_rights_to_nere_a_food_tree_species_in_Burkina_Faso [accessed Nov 19 2021]
3. DGEEVCC" (2017). Etude sur les aspects socioeconomiques des filières prioritaires des produits forestiers non ligneux : *Acacia macrostachya, Tamarindus indica, Balanites aegyptiaca, Adansonia digitata, Parkia biglobosa, Saba senegalensis, Vitellaria paradoxa, Ziziphus mauritiana, Bombax costatum,* 89 p
4. Enoch L. (2012). Impact des produits forestiers non ligneux (PFNL) sur l'économie des ménages et la sécurité alimentaire : cas de la République du Congo. *Economies et finances. Université Rennes 2.* Accessible à [/tel.archives-ouvertes.fr/tel-00713758/document](http://tel.archives-ouvertes.fr/tel-00713758/document)
4. INSD [Institut national de la statistique et de la démographie], 2006- Ministère de l'Economie et du Développement. *Recensement Général de la Population et de l'Habitat.* http://www.cns.bf/IMG/pdf/th_2_etat_et_structure_de_la_population_f.pdf
5. Joseph Issaka, B., Médah N., (2009). Méthodes de lutte contre les Loranthaceae. *Flora et Vegetatio Sudano-Sambesica 12, 27-35*
6. Joseph Issaka, B., Georges, S., Sita (1993). Tapinanthus parasite du karité au Burkina Faso. *Bois et Forêts des Tropiques. 238, 45-65.*
7. [MATD] Ministère de l'Aménagement du Territoire et de la Décentralisation. 2007. Projet de Plan de Développement Communal (PDC) de Bobo Dioulasso.

8. Marlène, E. (2015). Gender, knowledge-sharing and management of shea (*Vitellaria paradoxa*) parklands in central-west Burkina Faso. *J Rural Study*. 38:27–38.
9. Mawa, K., Marlène, E., Barbara V., Alexandra, G. (2017). Exploring local knowledge and preferences for shea (*Vitellaria paradoxa*) ethnovarieties in Southwest Burkina Faso through a gender and ethnic lens. *Forests, Trees and Livelihoods*, 2017 VOL. 26, N^o. 1, – <http://d.doi.org/10.1080/14728028.2016.1236708>
10. Tim, I. (2014) « *Culture, nature et environnement* », *Tracés. Revue de Sciences humaines* [En ligne], 22 2012, mis en ligne le 21 mai 2014, consulté le 16 janvier 2022. URL : <http://journals.openedition.org/traces/5470> ; DOI : <https://doi.org/10.4000/traces.5470>
11. Xavier, A., Paul, N., Emmanuel, T. (2006). Tree biodiversity, land dynamics and farmers' strategies on the agricultural frontier of Southwestern Burkina Faso. *Biodivers Conserv*. 15:613–630.