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Vulnérabilité des Produits Forestiers non Ligneux *'Vitellaria Paradoxa'* et *'Parkia Biglobosa'* au Burkina Faso - Une Évaluation des Perceptions de la Population Locale Basée sur le Genre et l'Ethnicité

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Résumé

L'objectif de cette étude est d'enquêter sur les connaissances et la perception des populations locales sur les menaces qui affectent les deux espèces que sont *Vitellaria paradoxa* et *Parkia biglobosa*. Le niveau de connaissance et la perception des individus peuvent être affectés par de nombreux facteurs. Mais la présente étude examine spécifiquement les effets du genre et de l'ethnicité sur les connaissances et la perception des populations locales. Les données ont été recueillies par le biais de discussions de groupe, avec un échantillon d'environ 100 participants. Les participants ont été divisés en cinq groupes sur la base des groupes ethniques rencontrés dans chacun des sites d'étude. Ainsi, les groupes suivants ont été formés : le groupe Mossi à Yarci (la population est composée uniquement de Mossi), les groupes Sambla et Mossi à Bana Lamogoya, et les groupes Bobo et Fulani à Bana Bobo. Cela donne un total de cinq groupes dans les trois sites. Dans chacun de ces cinq groupes ethniques, il a été constitué un groupe de femmes et un groupe d'hommes. Un total de 15 types de menaces, regroupés en trois facteurs : écologique, climatique et anthropique, ont été identifiés à Bana Bobo, Bana Lamogoya et Yarci par sexe et par les différents groupes ethniques. Les femmes ont cité deux (2) des trois (3) principaux facteurs de menace que sont

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: les plantes parasites et les attaques parasitaires (insectes et vers). Les Peuls sont ceux qui ont cité les 3 principaux facteurs de menace identifiés. Dans tous les sites étudiés, *Vitellaria paradoxa* est perçu comme l'espèce la plus vulnérable aux menaces comparativement à *Parkia biglobosa*. Les recherches futures devraient se concentrer sur les perceptions des participants des manifestations et les conséquences des menaces sur les arbres. Il sera également judicieux d'explorer les méthodes de lutte que les producteurs développent à leur niveau. Les connaissances locales peuvent constituer un point de départ précieux pour la recherche appliquée.

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

Vulnerability of Non-Timber Forest Products 'Vitellaria Paradoxa' and 'Parkia Biglobosa' in Burkina Faso - An Assessment to Perceptions of Local Population Based on Gender and Ethnicity

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Abstract

The objective of this study is to investigate knowledge and perception of local populations about the threats that affect the two species that are *Vitellaria paradoxa* and *Parkia biglobosa*. Individual knowledge level and perception may be affected by many factors. But the present study specifically examines the effects of gender and ethnicity on knowledge and perception of local people. The data were collected through focus group discussions, with a sample of approximparticipants. The participants were divided into five groups based on the ethnic groups encountered in each of the study site. Thus, the following groups were formed: the Mossi group in Yarci (the population is composed solely of Mossi), the Sambla and Mossi groups in Bana Lamogoya, and the Bobo and Fulani groups in Bana Bobo. This gives a total of five groups in all three sites. In each of these five ethnic groups, a group of women and a group of men were formed. 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 sites studied,

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Vitellaria paradoxa is perceived as the most vulnerable species to threats compared to *Parkia biglobosa.* Future research should focus on participants' perception of the manifestations and the consequences of these threats to trees. It will also be judicious to explore the methods that the producers are developing to combat threats at their level. Indigenous knowledge can serve as a valuable starting point for applied research.

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* or locust bean tree (néré) are the two (2) most important NTFPs. These two (2) species are involved in satisfying household's need through food, generating income, the marketing of products from these species, medicinal uses and other ecosystem services. The shea and néré 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 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 leads to 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 fight against the destruction of plant resources in Burkina Faso. Other ecological and biological factors threaten the survival and health of plants at an accelerated rate, as do 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. 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. Local perception is an indispensable approach for the study of threats to shea and locust bean 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 know the factors of threats to *Vitellaria paradoxa* and *Parkia biglobosa*

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and to analyze if there is a difference in the perception of threats according to the gender and ethnicity of the respondents. 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. It is also a contribution to the assessment of the vulnerability of the two species. The following research questions are formulated: what are the respondents' knowledge of threats that affect *Vitellaria paradoxa* and *Parkia biglobosa?* Are respondents' perception about threats vary according to their gender and ethnicity? What is respondents' understanding of the vulnerability of the two species regarding threats?

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. The two villages were selected because they are the intervention sites of the Bioversity International/Italy project. **(Fig. 1).**

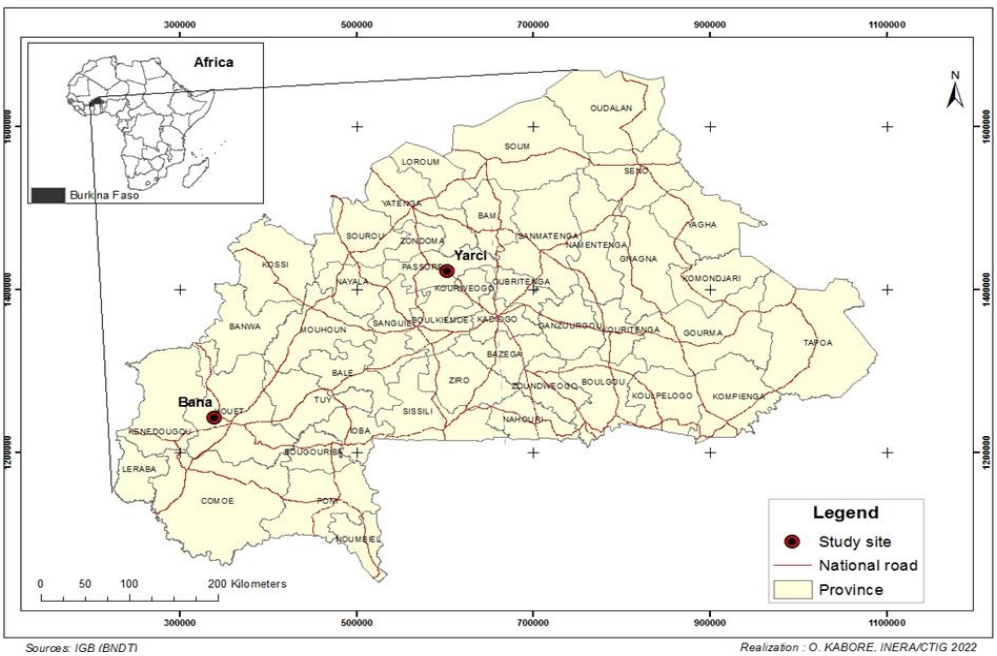

Figure 1. Location map of the study villages

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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*, *Afzelia 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

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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. In Yarci, the population is composed solely of Mossi. In Bana Lamogoya, Sambla and Mossi live together. Finally, in Bana Bobo, there are two (2) ethnic groups, the Bobo and the Fulani. This gives a total of 5 groups in the 03 sites. With each of these five groups, a group of women and a group of men was formed. In total, 10 focus groups were made. Each focus group included at least 10 adult participants giving a total of 104 members. The 104 participants consisted of 52 men and 52 women with ages ranging from 45 to 65 years.

During the focus group sessions, the participants were introduced to the research problem: what are their knowledge of threats that affect *Vitellaria paradoxa* and *Parkia biglobosa,* based on their gender and their ethnicity? And, what is their understanding of the vulnerability of the two species regarding threats?

Discussions were conducted in each group around these two themes. In each group, a moderator was assigned to facilitate the discussions and another person was responsible for taking notes on the different points of view and opinions developed during the group discussion sessions. The moderators took utmost precaution to avoid their influence on the discussion and try to provide each participant the chance to share its idea and view. The participants were asked to rate each proposed threat according to the Likert scale provided in the collection tool.

By the end of the session, the outputs from each focus group discussion were used to generate a final set of opinions about the themes. Thereafter, the participants were asked to rank the threats according to their degree of importance and to give their opinions regarding the vulnerability of the two tree species.

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 (± 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.

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The Chi-2 test was used in the SPSS software to study the relationships between the qualitative variables gender and ethnic group and the threat factors which are also qualitative variables.

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=not important; 2= unimportant; 3=moderately important; 4=important; 5=very important. The coded Likert scale values were summed and 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. The total score was calculated by adding the scores obtained by each respondent on each perception question. Once this score variable was found, the average score was then calculated

3. Results and discussions

3.1 Classification of threats by the respondents

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%).

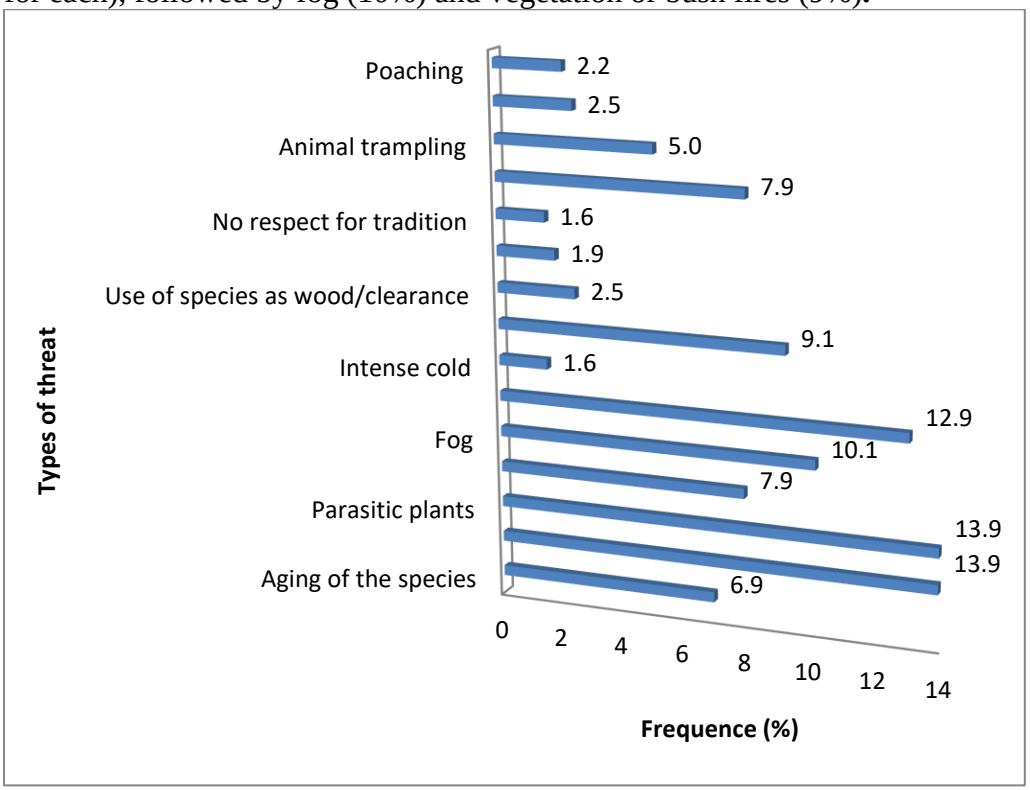

Figure 2: Threat factors cited by respondents

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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($\bar{x}$)**	**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 ($\dot{x}$=2.2), and violent winds ($\dot{x}$ =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 of the ANOVA test=0.00, therefore 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?

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3.2 Gender perception of the threats

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).**

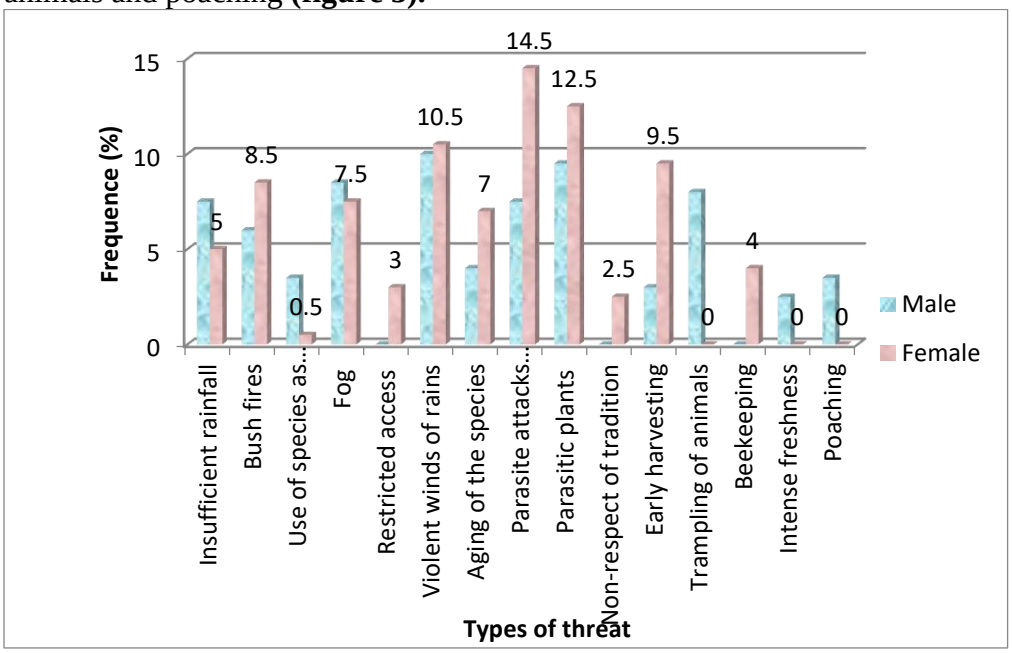

Figure 3. The main threats cited by men and women

The results indicate that there is a statistically significant relationship between gender (male or female) and knowledge of the threat factors (p of the Chi-square =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.

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

In Yarci for example, according to men, “the growth of a plant alien to the tree, also called a parasitic plant is very damaging to the host plant. The parasitic plant attacks the branches instead of the trunk, making them vulnerable and hindering the flowering and fruiting process. The parasitic plant depends entirely on the sap and nutrients of its host. It takes advantage of the mother tree, or the tree on which it grows. It is usually the old trees on which the parasitic plants grow”. According to them, "this leads to the unproductivity of the host tree which results in a strong decrease of foliage and a probable death of the species”.

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

3.3 Perception of the threats 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

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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 (néré) 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 "tchétchéhi" 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 of the Chi-square=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 the trees species according to gender and ethnicity

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.

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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). A study conducted by Nabaloum et al. (2022) declared *Vitellaria paradoxa (shea tree)* moderately vulnerable compared to others species

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

Explanatory 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?

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

Explanatory 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

There is any significant statistical relationship between gender and the vulnerability of locust bean nor between ethnicity and the vulnerability of this tree species. Indeed, the survey results give p-values above the 0.05 threshold for all the two variables (gender: 0.958 and ethnic groups: 0.958).

Conclusion

Local people's knowledge and perception of threats varies according to their gender and ethnicity. While some threats are occasional, temporal and circumstantial, others are recurrent, periodic, permanent and even intentional. Among all these threats, those resulting from anthropic actions remain the most violent and the most hostile to the survival of species. Women cited the majority of threats to *Vitellaria paradoxa* (shea) and *Parkia biglobosa* (néré), since they most involved in the exploitation of the two tree species. In reality, women play a leading role in the collection and processing of these two NTFPs. The Fulani cited the 3 main threat factors identified. *Vitellaria paradoxa* was perceived as the most vulnerable species to threats. Producers have a perfect knowledge of the threats to the two species, shea and néré. The study showed that opinions vary by gender and ethnicity. Future research should focus on participants' perception of the manifestations and the consequences of these threats to trees. It will also be judicious to explore the methods that the producers are developing to combat threats at their level. Local knowledge can provide a valuable starting point for applied research.

Conflicts of Interest: The author have no conflict of interest

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