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Cover: Common Keeled Skink *Eutropis carinata* in oil pastels, colour pencils, & micron pen adapted from photograph by H. Byju © Pooja Ramdas Patil.

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COMMUNICATION

Utilization of *Afzelia africana* Sm. ex Pers. (Magnoliopsida: Fabales: Fabaceae) in Nigeria and its implications for conservation

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Abstract: This study investigated the ethnobotanical uses of *Afzelia africana* Sm. ex Pers., a threatened tree species in Nigeria to determine the impact of uses of this species on the risk of its extinction. Ethnobotanical surveys were conducted by means of semi-structured questionnaires with the local community called Ijebu Igbo in Ogun state of Nigeria and a total of 60 respondents were interviewed from this community. Herbalists, artisans, Islamic scholars, traders, and retirees were interviewed to document their knowledge of the uses of *A. africana.* This study revealed that there are different uses of *A. africana*, among which its spiritual and medicinal uses were the most dominant. An unsustainable harvest of *A. africana* for these uses will aggravate the decline of its population, thereby increasing the risk of extinction. This study recommends local awareness of the indigenous people of possible ways this species can be utilized in a sustainable manner to prevent its extinction.

Keywords: Anthropogenic forces, biodiversity loss, endangered species, ethnobotany, extinction risk, indigenous knowledge, overharvesting, population decline, traditional knowledge, threats,

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Author contributions: Samuel Oloruntoba Bamigboye designed the project, and wrote the first draft of the manuscript and also assisted with the survey. Muhali Olaide Jimoh did the data analysis and proof reading. Falilat Abeni Lawal lead the survey team and documented information from the respondents, Zainab Temitope Osiyemi assisted in collecting data from the respondent, Charles Petrus Laubscher assisted in editing the manuscript, Learnmore Kambizi assisted in final editing of the manuscript.

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INTRODUCTION

Utilization and sustainability of biological resources are to be given high level consideration in controlling the risk of plant extinction because anthropogenic activities have been a major player in the subject of biodiversity conservation (Marchese 2015). Human craves to satisfy their needs in terms of food, medicine, shelter, clothing, and horticulture have increased decline in plant species globally (Haines-Young & Potschin 2010; Pimm 2021). And if these needs for resources are not effectively managed, the damage to global biodiversity might be beyond control in decades to come.

Perspectives of the indigenous knowledge holders is important in sustainable utilization and protection of biological resources (Cuni-Sanchez et al. 2016; Mensah et al. 2017). The interaction of local people with their natural environment is a factor that affects biodiversity conservation (Houdanon et al. 2018; Rasethe et al. 2022). Several plant species are sources of ecosystem services for many communities and the perception of the beneficiaries of these services is extremely important for the sustainability of these species (Brockerhoff et al. 2017). Some economic uses of plant resources in communities include timber production, medicine, firewood, and charcoal, and these are causing habitat degradation and gradual increase in extinction risk of many plant taxa (Diaz et al. 2019). Climate regulation, soil and environmental regulation are some of the ecological importance of indigenous trees in communities where the species exists (Byabashaija et al. 2004). Lack of sustainable utilization of species of trees will promote decline of their populations and this will further result in loss of ecosystem services (Jiao et al. 2019).

Afzelia africana (African Mahogany) is a tree species of high economic and ecological importance. It belongs to the family of Fabaceae (Oshingboye et al. 2017). It is highly desired for timber production (Balima et al. 2022), and currently listed as 'Vulnerable' on the IUCN Red List (Hills 2020; Bamigboye et al. 2022). Anthropogenic factors identified as a threat to this species are timber production, medicinal uses, livestock feeding and habitat destruction (Bamigboye et al. 2022). There are excessive threats to natural distribution of *Afzelia africana* in Africa due to international timber trade of this species (Mensah et al. 2014; Assogbadjo et al. 2017). The trade of this species as brown wood transcends Africa to Asia, Europe and the United States of America (Biara et al. 2021).

Afzelia africana is a widely harvested species for many ethnobotanical uses. It is being used for medicinal purposes to treat many ailments locally which include headache, Malaria, ulcer, chronic cough, tooth ache, hemorrhoids, stomach ache and Meningitis (Balima et al. 2018; Houehanou et al. 2023). The leaves are source of food for humans and livestock (Nzekwe et al. 2016; Avornyo et al. 2018). The main aim of this study is to conduct ethnobotanical surveys in a local community called Ijebu igbo in Nigeria to determine the perception of local people on the utilization of *Afzelia africana*. This is to determine the risk of extinction of this species based on the local uses and also make recommendations on the sustainability of this species in Nigeria. The specific objectives of this study are as follows: (i) to determine the diverse utilization of *Afzelia africana* and to understand how this utilization will increase the risk of extinction in a community in Ogun state Nigeria, (ii) to understand the usage of parts of this plant species that are heavily harvested by the local people to meet several human demands in the community where this study was conducted, (iii) to determine how the harvesting of different parts of *Afzellia africana* will affect its sustainability and regeneration potential, and (iv) to make recommendations on how the perspective of the local people can be integrated into plans and policies that will protect and minimize the risk of extinction of *Afzelia africana*.

MATERIALS AND METHODS

Study area

This study was conducted in Ijebu Igbo (Coordinates: 6.9792° N, 3.9980° E), Ogun-State, Nigeria. The natural vegetation is predominately deciduous forest (Bayewu et al. 2014). Ijebu Igbo in Ogun State Nigeria has an average temperature between 21°C–32°C (Bayewu et al. 2014). There are many indigenous people residing in this area. The main livelihood option in the region is timber harvesting (Olanipekun 2022). Majority of the natural forests have been converted to several farmlands and heavy deforestation occurs in this area because of timber trade.

Data collection

A semi structured questionnaires were administered to 60 people in the study area on the uses of *Afzelia africana* in their local community. The justification of the sample size is that only people who could identify the plant and gave their consent to be interviewed were the only respondents captured in this study. This survey was conducted in Yoruba, the local language of

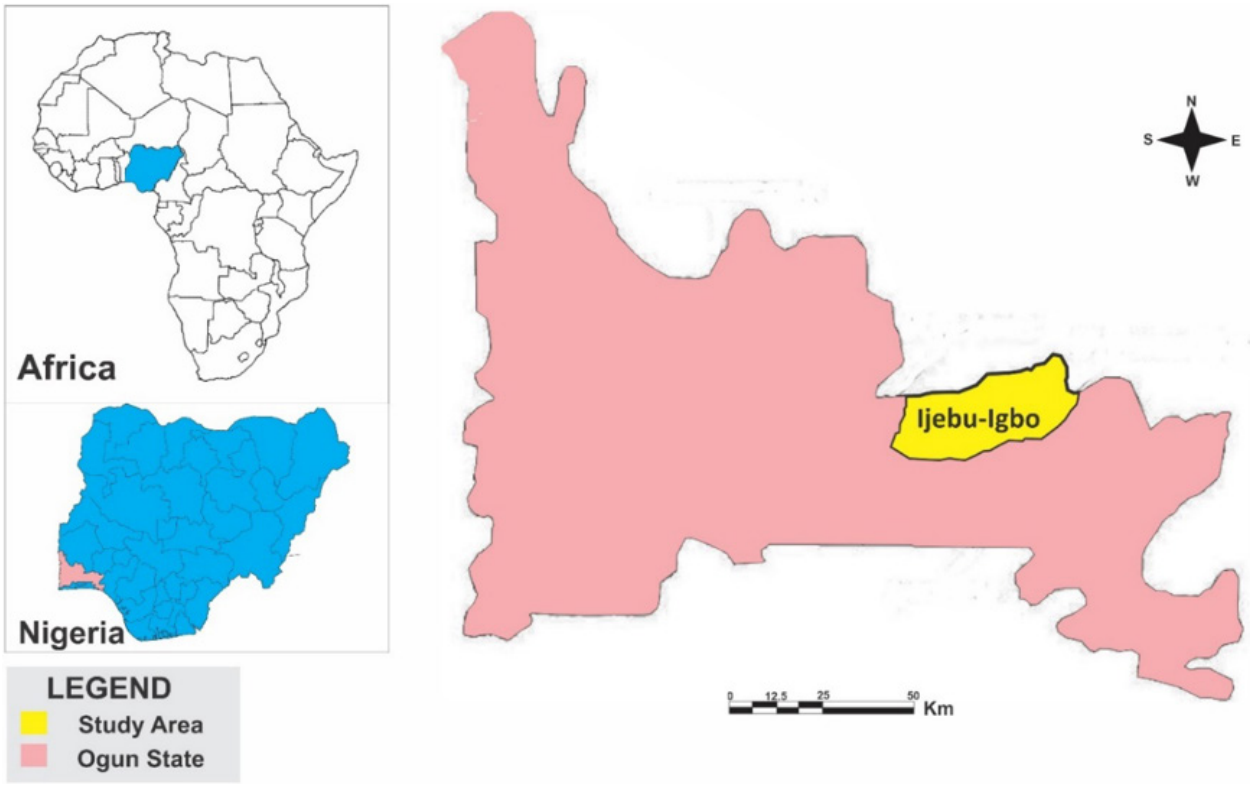

Figure 1. Map of the study area where the ethnobotanical survey of Afzelia africana was conducted.

the indigenous people in this community. Photographs of the species were taken along during the survey for identification and some of the indigenous knowledge holders volunteered to go and identify the species in the wild. *Afzelia africana* is called Apa in this community. All the respondents identified this species through this local name.

Data analysis

Descriptive statistics was used to analyze the data. Quantifications was done in percentages in which the percentages of respondents who mentioned different use categories was determined. The percentages that mentioned the parts of *Afzelia africana* being used for several purposes was calculated. The percentage of respondents that mentioned if the species is rare or not was calculated.

RESULTS

The highest percentage of the respondents mentioned that *Afzelia africana* is used for spiritual purpose. This implies that this plant species is common in this community for its spiritual uses (Figure 2). The spiritual uses mentioned includes warding off spiritual attacks, spiritual protection from evil spirits, money rituals and charm for having good luck. The parts used for spiritual purpose are the leaves, stem, bark, roots and the seeds.

After the spiritual purpose the medicinal uses were the second most mentioned by the respondents (Figure 2). The medicinal uses mentioned are wound healing, easing childbirth, treating eye infection, gonorrhea, enhancing male sexual performance, treating lap inflammation and curing food poison. This revealed there is a wide range of medicinal uses of this plant species with the bark, root, leaves and seeds used for various medicinal purposes (Table 1; Figure 3).

The seed of *Afzelia africana* is a source of food for human consumption as reported in this study (Table 1; Figure 3). It is being uses locally for soup making and added to other food items for human consumption. Also, there are other uses which include furniture making, timber production and as a source of firewood mentioned by the respondents (Figure 2). Individuals of this species are taken out completely for timber production through the use of the industrial saw. The stem cut down are broken into smaller pieces with axe for producing firewood. This is a common practice

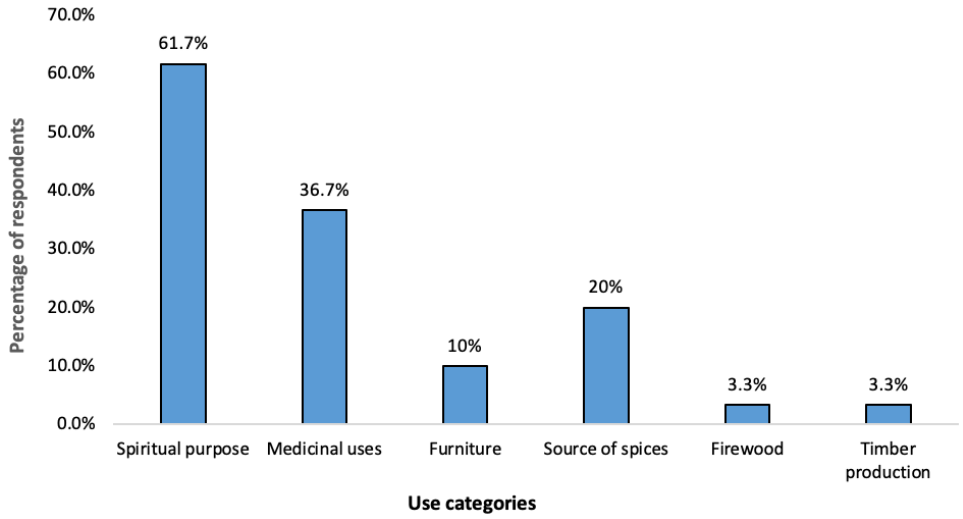

Figure 2. Percentages of respondents that mentioned different use categories of *Afzelia Africana*.

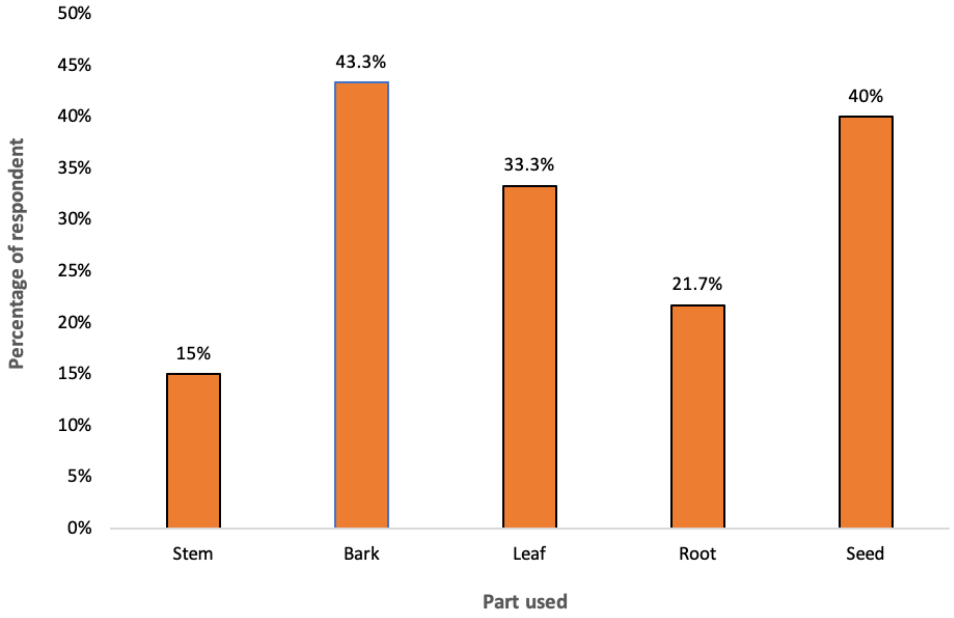

Figure 3. Percentages of respondents that mentioned different parts of *Afzelia africana* used for different purposes.

throughout the year round. Because individuals being removed for timber production and firewood in the wild are not being replaced by planting, this practice becomes unsustainable. This contributes to the population decline of this species.

Half of the respondents believed that *Afzelia africana* is becoming rare within the community (Figure 4). Although a few respondents do not know whether it is rare or not but the result can still be justified that there is possibility of increase in decline of the population of this species within this community.

DISCUSSION

Harvesting of *Afzelia africana* for spiritual purpose

There are many spiritual beliefs that are being attached to plants (Gupta 1971, 1996; Negi 2005). Many cultures around the world believe that plants have several spiritual uses (Kandari et al. 2014; Kawa 2016; Bamigboye et al. 2017; Aziz et al. 2020). The main use category mentioned by most of the respondents in this study was the use of *Afzelia africana* for spiritual purpose

Table 1. Demographic information on the respondents, the use categories of *Afzelia africana* mentioned, parts used mentioned and perception of rarity of the respondent regarding the species.

	Gender	Occupation	Age	Uses	Part used	Is the plant rare or not?
1	Male	Carpenter	54	Furniture, medicine	Stem, leaves	Not rare
2	Male	Unknown	49	Firewood	Stem	Not rare
3	Male	Farmer	61	Cooked as soup, medicine (leaves boiled and administered orally to improve men sexual performance)	Seed, leaves	Not rare
4	Female	Market woman	48	Cooked as soup, medicine	Leaves, seed	Not rare
5	Female	Market woman	39	Cooked as soup, medicine	Leaves, seed	Rare
6	Male	Unknown	62	Spiritual purpose, medicine (Gonorrhea)	Leaves, seed	Unknown
7	Male	Driver	54	Spiritual purpose, medicine (Roots for treating wound)	Bark, root	Not rare
8	Female	Trader	59	Cooked as soup	Seed	Not rare
9	Male	Trader	49	Medicine (Gonorrhea), spiritual purpose	Leaves, bark	Rare
10	Male	Trader	67	Furniture, cooked as soup	Seed, stem	Rare
11	Male	Farmer	68	Cooked as soup	Seed	Not rare
12	Male	Herbalist	51	Spiritual purpose, medicine (Gonorrhea)	Bark, leaves	Not rare
13	Male	Pastor/farmer	63	Spiritual purpose, medicine (bark is boiled and administered to babies orally to strengthen their bones, roots used for treating unknown illness)	Seed, bark, root	Rare
14	Male	Herbalist	58	Spiritual purpose	Seed, leaves	Not rare
15	Male	Herbalist	61	Spiritual purpose, medicine (roots use for enhancing sexual performance in men)	Bark, seed, leaves, root	Rare
16	Male	Herbalist	56	Spiritual purpose, Medicine (roots used for treating wounds)	Leaves, root	Not rare
17	Female	Trader	53	Cooking	Seed	Unknown
18	Female	Trader	47	Cooking, medicine	Seed, leaves	Rare
19	Male	Drummer	55	Furniture	Stem	Not rare
20	Male	Driver	62	Medicine (roots used for treating wounds)	Roots	Unknown
21	Female	Trader	Unknown	Cooking	Seed	Rare
22	Male	Unknown	70	Spiritual purpose	Seed, stem	Rare
23	Female	Trader	45	Cooking	Seed	Not rare
24	Female	Trader	56	Cooking, medicine	Seed, leaves	Not rare
25	Male	Herbalist, Mechanic	40	Spiritual purpose	Bark, root	Rare
26	Female	Herbalist	80	Spiritual purpose, medicine (healing of eyes)	Seed,	Not rare
27	Male	Farmer	58	Spiritual purpose	Bark	Not rare
28	Male	Herbalist	55	Medicine (for curing poison)	Bark	Rare
29	Male	Herbalist	55	Spiritual purpose	Bark	Rare
30	Male	Farmer	58	Spiritual purpose	Bark, seed	Rare
31	Male	Herbalist	85	Medicine (Wound healing, lap inflammation cure)	Seed	Rare
32	Male	Herbalist	54	Spiritual purpose, furniture	Bark	Rare
33	Male	Islamic scholar	45	Spiritual purpose, furniture	Leaves, bark	Not rare
34	Male	Islamic scholar	40	Spiritual purpose	Leaves	Rare
35	Male	Islamic scholar	55	Spiritual purpose	Stem,	Not rare
36	Male	Farmer	56	Spiritual purpose	Seed, bark	Not rare
37	Male	Herbalist	50	Spiritual purpose	Bark	Rare
38	Male	Islamic scholar	42	Spiritual purpose	Bark	Rare
39	Male	Islamic scholar	40	Spiritual purpose	Leaves, roots	Rare
40	Male	Islamic scholar	45	Medicine (Ease childbirth)	Seed, leaves, root	Rare

	Gender	Occupation	Age	Uses	Part used	Is the plant rare or not?
41	Male	Herbalist	50	Spiritual purpose	Root, leaves	Rare
42	Male	Herbalist	60	Spiritual purpose	Bark	Unknown
43	Male	Herbalist	55	Spiritual purpose, Medicine (aphrodisiac)	Root	Unknown
44	Male	Herbalist	50	Spiritual purpose	Seed	Unknown
45	Male	Herbalist	65	Spiritual purpose	Bark	Unknown
46	Male	Farmer/ Herbalist	56	Furniture, medicine (aphrodisiac), spiritual purpose	Seed, bark, root	Unknown
47	Female	Traditional nurse	54	Spiritual purpose	Leaves	Rare
48	Male	Trader	65	Spiritual purpose	Leaves, roots, bark	Rare
49	Male	Islamic scholar	48	Spiritual purpose	Bark	Rare
50	Female	Herbalist	58	Spiritual purpose	Bark	Rare
51	Male	Herbalist	45	Spiritual purpose	Bark	Not rare
52	Female	Trader	40	Spiritual purpose	Bark	Rare
53	Male	Islamic scholar	50	Spiritual purpose	Bark	Not rare
54	Female	Trader	56	Medicine (Rheumatism)	Bark	Rare
55	Female	Trader	55	Cooking	Seed	Not rare
56	Male	Carpenter	42	Firewood	Stem	Not rare
57	Male	Herbalist	60	Spiritual purpose	Bark	Rare
58	Male	Islamic scholar	48	Spiritual purpose	Seed	Rare
59	Male	Carpenter	Unknown	Timber production	Stem	Rare
60	Female	Trader	50	Timber production, medicine	Stem, root, leaves	Rare

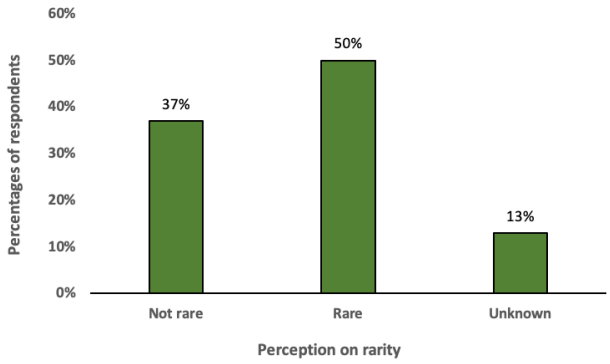

Figure 4. Percentages of respondents that showed their knowledge on rarity of Afzelia africana where this study was conducted.

(Figure 2). A study conducted by Balima et al. (2018) on ethnobotany of *Afzelia africana* in Burkina Faso revealed that after fodder and medicine, the most common uses of this species were the use for spiritual purpose. This revealed in a community in Burkina Faso, *Afzelia africana* is known for spiritual uses but not as common as medicinal and fodder while in Ijebu Igbo a small community in Nigeria where this study was conducted *Afzelia africana* is more popular for spiritual uses than uses for medicine and fodder (Figure 2). Studies have shown that certain communities preserve some plant species due to some spiritual perception attached to the plant species (Shukla & Gardner 2006; Irakiza et al. 2016; Rankoana 2016; Yeshi et al. 2021). Also, the study by Balima et al. (2018) further revealed that *Afzelia africana* is protected in the traditional agroforest systems in Burkina Faso due to the spiritual belief attached to this plant. This implies that the spiritual perception of this plant species might contribute to the local conservation of this species.

Harvesting of *Afzelia africana* for medicinal uses

Plant harvest for medicinal purposes keeps generating concerns in biodiversity conservation (Jimoh et al. 2023). Continuous harvest of threatened species for medicinal uses will keep aggravating the decline of their populations (Williams et al. 2013; Bamigboye et al. 2017; van Wyk & Prinsloo 2018). Harvest for medicinal uses have been identified as a threat to *Afzelia africana* (Bamigboye et al. 2022). Next to spiritual purpose, harvest for medicinal uses was the most mentioned by the respondents in this study (Figure 2). Continuous harvest of this species for medicinal purpose will

increase the risk of extinction of this species if not done in a sustainable manner.

Bark harvesting of *Afzelia africana*

Bark harvesting have been a practice responsible for plant species extinction (Bamigboye et al. 2018). Bark harvesting can lead to death of individuals of tree species and it can result into poor regeneration of tree species (Tshisikhawe et al. 2012). Nacoulma et al. (2016) revealed that bark harvesting of *Afzelia africana* reduced its fruit production, thereby affecting its reproduction. This study identified bark harvesting of *Afzelia africana* for spiritual and medicinal purpose as common practice in this community where this study was conducted (Table 1; Figure 3). The practice of bark harvesting will reduce the regeneration potential of this species if they are not done in a sustainable way.

Harvesting of *Afzelia africana* for timber production

Harvest of tree taxa for timber production poses threats to the survival of many tree species and it has exterminated many populations of tree taxa hence increase their risk of extinction (Edward et al. 2014; Bont et al. 2020). The economic viability of this adventure has made many people defer regulations and engage in indiscriminate harvest of so many trees which is contributing to biodiversity loss (Frey et al. 2021). From ecological perspective, arboreal species that survive based on the presence of these trees have to migrate through ecological corridors due to habitat fragmentation (Arroyo-Rodríguez & Mandujano 2009). The susceptibility of these species to habitat fragmentation is due to the practice of removing individuals of tree species from the wild for timber production. Some studies have reported *Afzelia africana* being excessively harvested for timber production and also project this practice as the main threats to this species (Mensah et al. 2014; Assogbadjo et al. 2017; Biara et al. 2020). In a bit of a contrary, this study found this plant to be more desired in Ijebu Igbo, Ogun-State, Nigeria where this study was conducted for spiritual and medicinal purposes more than that for timber production (Figure 2). This implies that there may be less popularity of this species for timber production in this area or the spiritual belief attached to the plant might have restricted the practice of harvesting this species for timber production.

Perception on rarity of *Afzelia africana*

Perception on rarity is extremely important in biodiversity. Species perceived to be rare can become target of harvest for economic gains thereby increasing their risk of population decline (Courchamp et al. 2006; Hall et al. 2008). Online and offline resources consulted on this subject could not reveal that *Afzelia africana* is currently protected in Nigeria. Based on the current perception on the rarity of the species (Figure 4) in this study, it is recommended that *Afzelia africana* should be protected in Nigeria.

CONCLUSION

This study revealed that several parts of *Afzelia africana* are being harvested for different purposes which might keep declining the populations of this species in the wild. Intensive harvest over time will further aggravate the risk of extinction of *Afzelia africana* in Nigeria. This study recommends that further studies on population ecology of *Afzelia africana* should be carried out to determine the current status of this species in terms of conservation in Nigeria. There is a need for creating local awareness among the indigenous people on the need to conserve this species. Prohibition of indiscriminate harvest of *Afzelia africana* should be enacted by local conservation authorities. Local cultivation of *Afzelia africana* within the region of this study should be encouraged to prevent extirpation of this species and also improve its regeneration in Nigeria.

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