

Socioeconomic and Land-Tenure Dynamics Influencing the Sustainable Management of Agroforestry Species in Sandéniah, Faranah Prefecture, Guinea

Alexandré Konaté¹, Lucie Duonamou^{1*}, Adama Sirima², Vamougnè Kourouma², Adigla Apollinaire Wedjangnon¹, Abdoulaye Aguibou Diallo³, Soua Julienne Molmou¹, Delphine Adadedjan^{1,4}

¹Higher Institute of Agronomy and Veterinary Sciences of Faranah (ISAV/F), Department of Water, Forest and Environment, Faranah, Guinea

²Higher Institute of Agronomy and Veterinary Sciences of Faranah (ISAV/F), Department of Agriculture, Faranah, Guinea

³Higher Institute of Agronomy and Veterinary Sciences of Faranah (ISAV/F), Department of Animal Sciences, Faranah, Guinea

⁴Department of Natural Resources Planning and Management, University of Abomey-Calavi, Abomey-Calavi, Benin

Email: *lucieduonamou86@gmail.com

How to cite this paper: Konaté, A., Duonamou, L., Sirima, A., Kourouma, V., Wedjangnon, A.A., Diallo, A. A., Molmou, S. J., & Adadedjan, D. (2026). Socioeconomic and Land-Tenure Dynamics Influencing the Sustainable Management of Agroforestry Species in Sandéniah, Faranah Prefecture, Guinea. *Open Journal of Forestry*, 16, 431-446.

<https://doi.org/10.4236/ojf.2026.164025>

Received: July 29, 2026

Accepted: October 27, 2026

Published: October 30, 2026

Copyright © 2026 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Agroforestry species constitute a fundamental component of rural production systems in sub-Saharan Africa, contributing significantly to food security, biodiversity conservation, and the improvement of rural livelihoods. However, their long-term sustainability is increasingly threatened by growing anthropogenic pressures and environmental change. This study aims to analyze the socioeconomic and land tenure dynamics influencing the sustainable management of agroforestry species in the Sandéniah District, Faranah Prefecture in Republic of Guinea. A socioeconomic survey was conducted among 85 respondents representing different groups of local stakeholders. Data were collected through semi-structured questionnaires, semi-structured interviews, and direct field observations. Descriptive statistics including frequencies and percentages, means, and standard deviations were used to summarize the data, while chi-square tests were used to examine associations between categorical variables. The results indicated that men represented 63.5% of the respondents and that the mean age was 40.5 ± 13.7 years. Reported socioeconomic activities included agriculture, charcoal production, livestock farming, fishing, beekeeping, and small business. The most frequently conserved species were *Parkia biglobosa* (57.6%), *Gmelina arborea* (16.5%), and *Azizelia africana* (9.4%). The most frequently reported reasons for conservation were commercial use

(38.8%) and food provision (35.3%). Land was accessed mainly through inheritance (37.6%) and gifts (32.9%). A statistically significant association was observed between land tenure and the species conserved ($\chi^2 = 24.58$, $df = 12$, $p = 0.017$; Cramér's $V = 0.31$), whereas no significant association was observed between gender and species conserved ($\chi^2 = 0.63$, $df = 4$, $p = 0.960$; Cramér's $V = 0.09$). These findings indicate that local land-tenure arrangements are an important factor associated with the conservation of agroforestry species in Sandéniah. Strengthening locally appropriate land-tenure governance and participatory management approaches could therefore support the sustainable management of these species.

Keywords

Sustainable Land Management, Agroforestry Species, Land Tenure, Sandéniah, Republic of Guinea

1. Introduction

Agroforestry species are an important component of rural production systems in sub-Saharan Africa because they provide multiple ecological, economic, and social benefits (Nair et al., 2021). Trees retained or deliberately integrated into agricultural landscapes contribute to soil fertility, erosion control, biodiversity conservation, carbon sequestration, food production, traditional medicine, fuelwood supply, and household income (Leakey, 2014; IPCC, 2019a). In West Africa, agroforestry parklands are particularly important for supporting food security and rural livelihoods while providing products and ecosystem services that increase the resilience of farming communities (Bayala & Harmand, 2023). In Guinea, and particularly in the Upper Guinea region, agroforestry systems similarly contribute to household food security, income diversification, and the sustainable use of natural resources.

Despite these benefits, the sustainability of agroforestry resources is increasingly challenged by agricultural expansion, charcoal production, unsustainable exploitation of woody resources, population growth, land-use change, and climate-related pressures (FAO, 2022; IPCC, 2019b; IPCC, 2023). These pressures can reduce vegetation cover, alter the availability of economically valuable tree species, and weaken the ecosystem services on which rural households depend. The problem is particularly important in areas where agriculture and other natural-resource-dependent activities constitute the principal sources of livelihoods (Zhou et al., 2011). In such contexts, the conservation of agroforestry species is influenced not only by ecological pressures but also by the socioeconomic importance attributed to individual species, local management practices, and the way agricultural land is accessed and controlled (Kumar & Nair, 2011).

In the Sandéniah District of Faranah Prefecture, local communities depend substantially on agriculture, livestock production, charcoal production, and other

natural-resource-based activities. Agroforestry species such as *Parkia biglobosa*, *Vitellaria paradoxa*, *Adansonia digitata*, and *Tamarindus indica* provide food, income, medicinal products, and other benefits to local households (Fandohan et al., 2010). At the same time, increasing pressure from agricultural activities and other forms of resource exploitation may threaten the persistence of valuable agroforestry species. The sustainability of these resources therefore depends on understanding not only the direct pressures exerted on agroforestry trees but also the socioeconomic and institutional factors that influence farmers' conservation decisions.

However, important knowledge gaps remain at the local level. Although previous studies have demonstrated the importance of agroforestry trees for rural livelihoods in West Africa, limited empirical information is available on the specific socioeconomic activities threatening agroforestry species in Sandéniah and on the factors that influence which species local communities choose to conserve. In particular, the role of land-tenure arrangements in shaping species conservation choices has received limited attention in this local context. Understanding these relationships is important because access to agricultural land and the security associated with different tenure arrangements may influence farmers' decisions concerning the retention, management, and conservation of trees on their farms.

This study therefore addresses the following research questions: 1) What socioeconomic activities constitute the main threats to agroforestry species in the Sandéniah District? 2) Which agroforestry species are most frequently conserved by local communities, and what are the principal reasons for their conservation? and 3) Is there an association between land-tenure arrangements and the agroforestry species conserved by local communities? These questions were addressed using socioeconomic surveys, interviews, and field observations involving farmers and other local stakeholders.

The novelty of this study lies in providing empirical evidence from Sandéniah, an area of Upper Guinea for which information on the socioeconomic and land-tenure dimensions of agroforestry species conservation remains limited. Rather than considering agroforestry conservation only from an ecological perspective, this study links local livelihood activities, the socioeconomic value of tree species, and land-tenure arrangements to conservation choices. The findings therefore contribute to a better understanding of the social and institutional factors that shape agroforestry resource management in Guinea and provide locally relevant evidence for strengthening participatory conservation and sustainable land-management strategies.

Accordingly, the objective of this study was to assess the challenges associated with the sustainable management of agroforestry species in the Sandéniah District, Faranah Prefecture, Guinea, with particular emphasis on the socioeconomic activities threatening these resources, the species conserved by local communities, the motivations for their conservation, and the relationship between land-tenure arrangements and species conservation. By focusing on these dimensions, the

study seeks to identify the principal constraints to sustainable agroforestry management and to provide a scientific basis for locally appropriate conservation and management strategies.

2. Materials and Methods

2.1. Study Site

The study was conducted in the Sandéniah sub-prefecture of Faranah Prefecture, in the Upper Guinea region of central-eastern Guinea. Sandéniah is located at approximately 10°09' N latitude and 11°03' W longitude, with a mean elevation of about 509 m above sea level. According to the 2014 national population census, the sub-prefecture had an estimated population of approximately 17,500 inhabitants, most of whom live in rural communities. The main settlements include Bontala, Komboya, Kassaya, Bétébèkhi, Niaya-Forita, and Sandéniah Mosque ([Institut National de la Statistique, 2017](#)). The study area has a Sudano-Guinean tropical climate characterized by two distinct seasons: a rainy season generally extending from May to October and a dry season from November to April.

Sandéniah was selected as the study site because it provides a relevant local setting for examining the socioeconomic and land-tenure factors influencing the management of agroforestry species in Upper Guinea. The area is characterized by a strong dependence of rural households on rainfed agriculture, extensive livestock production, charcoal production, rural trade, hunting, and other natural-resource-based activities. These livelihood activities create a direct interface between agricultural production, natural-resource use, and the conservation of agroforestry trees. The study area therefore provides an appropriate context for assessing the challenges associated with the sustainable management of agroforestry species and for examining how livelihood needs and land-access arrangements may influence conservation decisions. The scientific relevance of Sandéniah is further supported by its characteristic Upper Guinea landscape, where wooded savannas, gallery forests, and agroforestry parklands occur in close association with agricultural areas. Agroforestry systems consist mainly of multipurpose trees retained within croplands and around homesteads, where they contribute to agricultural production, biodiversity conservation, and rural livelihoods ([Ministère de l'Agriculture et de l'Élevage, 2023](#)). This combination of agricultural land use, natural vegetation, and tree-based production systems makes Sandéniah a suitable case study for investigating the sustainable management of agroforestry species under conditions representative of the agroecological and socioeconomic context of Upper Guinea. Climatically, Sandéniah belongs to the Sudano-Guinean climatic zone and experiences a pronounced seasonal rainfall regime, with a rainy season generally extending from May to October and a dry season from November to April. For the Faranah area, available long-term climate data classify the climate as tropical savanna (Köppen-Geiger Aw), with a mean annual temperature of approximately 25.9°C and mean annual precipitation of about 1637 mm based on ERA5 climate data for 1940-2025. Rainfall is strongly seasonal, with the

highest precipitation occurring during the July-September period. These climatic conditions, combined with the predominantly agricultural land use and the occurrence of wooded savannas, gallery forests, and agroforestry parklands, provide an important environmental context for understanding agroforestry management in the study area. The terrain is predominantly flat, with extensive plains and low-lying areas. The soils are mainly tropical ferruginous soils that support the cultivation of rice, maize, groundnut, cassava, and fonio. Seasonal streams and wetlands also contribute to local agricultural activities, particularly dry-season vegetable production. The local economy is primarily based on agriculture, livestock production, rural trade, and natural-resource use (Figure 1).

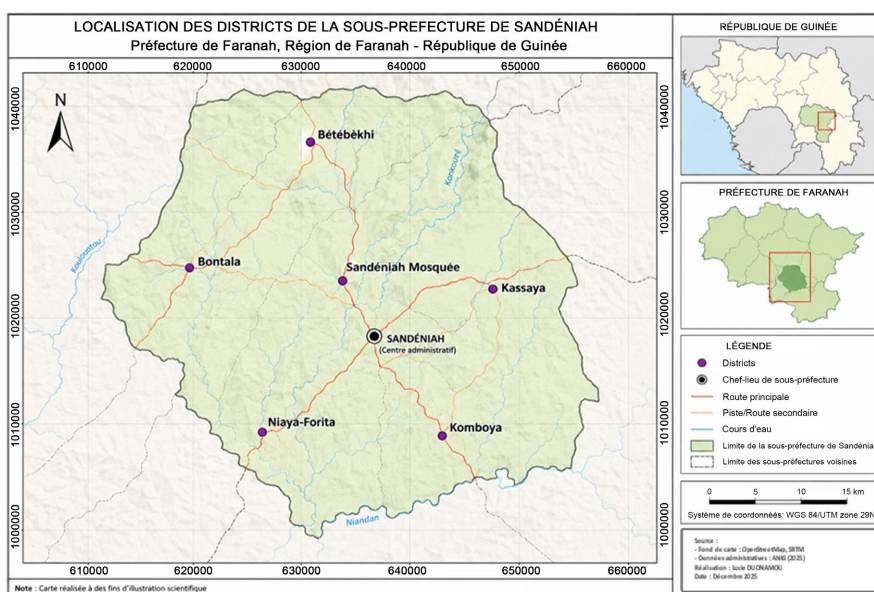


Figure 1. Location of the study area (Sandéniah).

2.2. Data Collection

This study employed a descriptive and analytical research design, integrating both quantitative and qualitative approaches. The mixed-methods framework was adopted to provide a comprehensive understanding of the interactions between local farming practices and the sustainable management of agroforestry species. Data were collected between October and December 2025. We followed the methodology outlined by several authors (Creswell & Creswell, 2023; Fowler, 2014; Bernard, 2021). A total of 85 participants were included in the socioeconomic survey, comprising farmers, livestock keepers, hunters, community elders, local government authorities, and technical service agents. The participants included 54 men and 31 women. The sample consisted of 45 farmers, 15 livestock keepers, 8 technical service agents, 7 local government authorities, 6 community elders, and 4 hunters (Table 1). Participants were selected using a purposive sampling. The sampling strategy was adopted to ensure the inclusion of stakeholders with direct knowledge of agricultural production, livestock management, natural-resource

use, land management, and agroforestry conservation in the study area. Participants were purposively selected based on their involvement in agroforestry resource use and management. The sample size of 85 participants was determined based on the available target population. The sample was considered sufficient to capture the diversity of stakeholders perspectives relevant to the objectives of the study. Because the study focused on specific stakeholder groups and used a mixed-methods design, the findings are interpreted primarily in relation to the surveyed participants and the study area rather than as statistically representative of the entire population of Guinea. To minimize dependence among observations, only one individual was interviewed from each household or family. Thus, two individuals from the same family or household were not included in the individual survey, even when they were not directly related.

Table 1. Survey sample included the following stakeholder groups.

N°	Target groups	Participants			Study site
		M	F	T	
1	Technical service agents	6	2	8	Sandeniah
2	Hunters	4	-	4	
3	Community elders	4	2	6	
4	Local government authorities	5	2	7	
5	Farmers	20	25	45	
6	Livestock keepers	15	0	15	
Total		54	31	85	

Legend: H = Male; F = female; T = total.

2.3. Questionnaire Development and Data Collection

Individual interviews were conducted using a structured questionnaire and standardized data-collection forms specifically developed for this study. The questionnaire was organized into several sections covering: i) sociodemographic characteristics of respondents; ii) agroforestry species conserved on farms; iii) uses of the conserved species; iv) reasons for conserving these species; v) land tenure and access arrangements; vi) agroforestry management practices; vii) perceptions of the need for species conservation; viii) socioeconomic importance of agroforestry species; ix) socioeconomic activities threatening their persistence; x) challenges associated with their sustainable management; and xi) potential strategies for promoting their conservation and rational use. Before the main survey, the questionnaire was pre-tested with 50 respondents who were from a comparable community. The pre-test was used to assess the clarity, relevance, sequence, and comprehensibility of the questions, and the questionnaire was subsequently revised accordingly. The questionnaire was administered through face-to-face interviews. Where necessary,

questions were explained in a language understood by the respondent to minimize misunderstanding and ensure that participants could provide informed responses. The survey covered the principal stakeholder groups involved in natural-resource management in the study area, including farmers, livestock keepers, hunters, local authorities, community elders, and technical service personnel.

2.4. Focus Group Discussions

Focus group discussions (FGDs) were conducted as a qualitative component of the study to complement the individual survey and provide more detailed information on community perceptions, local knowledge, management practices, and challenges related to the sustainable management of agroforestry resources. A total of 12 focus group discussions were organized, with approximately 7 participants per group. Participants were selected to reflect the principal stakeholder groups and groups were organized separately according to stakeholder category in order to facilitate open discussion and comparison of perspectives. Each discussion lasted approximately 20 to 45 minutes. The discussions were guided by a semi-structured discussion guide addressing the main themes investigated in the questionnaire, including the importance and uses of agroforestry species, local conservation practices, factors contributing to species degradation, land-tenure issues, perceived constraints to sustainable management, and possible conservation strategies. The discussions were moderated by team member recorded the main points and observations. Participants were encouraged to express their views freely, and the discussions continued until the principal themes relevant to the research objectives had been adequately explored. Information obtained from the focus groups was used to complement and contextualize the quantitative findings from the individual interviews.

2.5. Ethical Considerations

Before each interview and focus group discussion, participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to decline to answer any question or withdraw from the study without consequence. Oral informed consent was obtained from each participant before data collection. To protect confidentiality, participants' names and other personally identifying information were not included in the analytical database or reported in the manuscript. Responses were treated confidentially and were used exclusively for research purposes.

Before the field data collection, Ethical approval for the study was obtained from the Ethics Committee in the Higher Institute of Agronomy and Veterinary Sciences of Faranah (ISAV/F), Department of Water, Forest and Environment, Faranah, Republic of Guinea, before field data collection.

2.6. Data Analysis

The data were analyzed using Microsoft Excel and IBM SPSS Statistics software.

Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed. Associations between categorical variables were examined using Pearson's chi-square test. Statistical significance was assessed using a two-sided significance level of $p < 0.05$. Expected cell frequencies were also examined when interpreting chi-square results; because several cells in the land-tenure-by-species table had expected frequencies below 5, that association was interpreted with caution.

3. Results

3.1. Socio-Demographic Characteristics

The study included 85 participants representing different stakeholder groups involved in natural resource management in the Sandéniah sub-prefecture. Of the respondents, 54 (63.5%) were men and 31 (36.5%) were women.

Respondents ranged in age from 21 to 89 years, with a mean age of 40.5 ± 13.7 years. The age-group distribution was 23.5% for 21 - 30 years ($n = 20$), 40.0% for 31 - 40 years ($n = 34$), 22.4% for 41 - 50 years ($n = 19$), 7.1% for 51 - 60 years ($n = 6$), and 7.1% for ≥ 61 years ($n = 6$) (Figure 2).

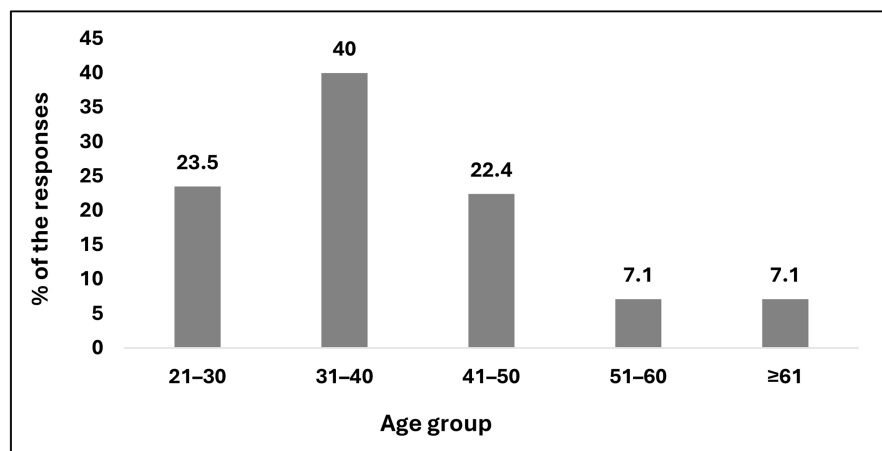


Figure 2. Distribution of respondents by age group.

3.2. Socioeconomic Activities Reported by Respondents

Respondents reported several socioeconomic activities, including agriculture, charcoal production, livestock farming, fishing, beekeeping, and small business activities (Figure 3). Based on the reported activity responses, agriculture accounted for 47.05%, charcoal production for 23.17%, livestock farming for 12.76%, fishing for 9.23%, beekeeping for 7.05%, and small business for 4.70% (Figure 3). These percentages describe the distribution of reported activity responses and are not mutually exclusive respondent categories.

Modes of land acquisition

Figure 4 presents the main modes of land acquisition identified in the survey. Four types were observed: Inheritance, Gift, Loan, and Lease. Inheritance was the

most frequently reported mode of farmland acquisition (37.6%), followed by gifts (32.9%), loans (15.3%), and leases (14.1%) (**Figure 4**).

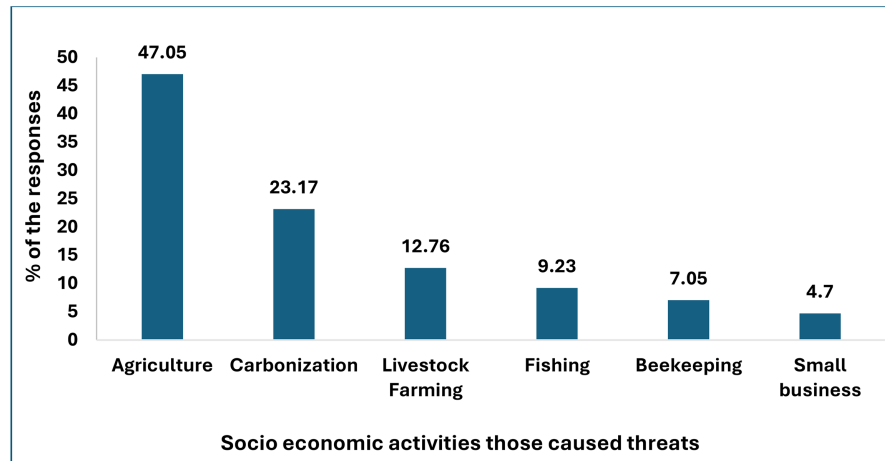


Figure 3. Distribution of socioeconomic activities reported by respondents in the study area.

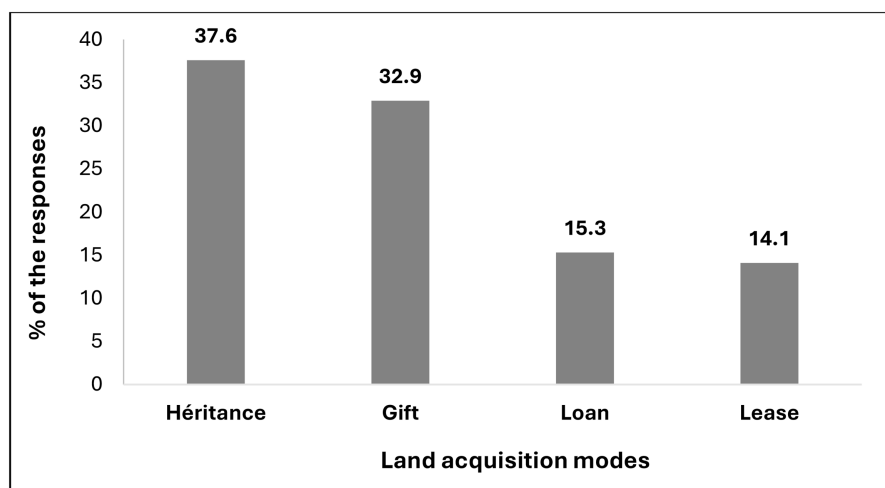


Figure 4. Distribution of respondents according to modes of farmland acquisition in the study area.

3.3. Conserved Agroforestry Species

Figure 5 illustrates the distribution of agroforestry species conserved in the Sandéniah area. Five agroforestry species were recorded: *Parkia biglobosa*, *Gmelina arborea*, *Azelia africana*, *Detarium senegalense*, and *Cola cordifolia* (**Figure 5**). *Parkia biglobosa* was the most frequently reported conserved species (57.6%; $n = 49$), followed by *Gmelina arborea* (16.5%; $n = 14$), *Azelia africana* (9.4%; $n = 8$), *Detarium senegalense* (8.2%; $n = 7$), and *Cola cordifolia* (8.2%; $n = 7$). The Pearson chi-square test showed a statistically significant association between mode of land tenure and conserved species ($\chi^2 = 24.58$, $df = 12$, $p = 0.017$; Cramér's $V = 0.31$). The corresponding contingency table contained 15 of 20 cells (75%) with expected frequencies below 5; therefore, the Pearson chi-square result should be

interpreted with caution. In contrast, no statistically significant association was observed between respondents' gender and conserved species ($\chi^2 = 0.63$, $df = 4$, $p = 0.960$; Cramér's $V = 0.09$).

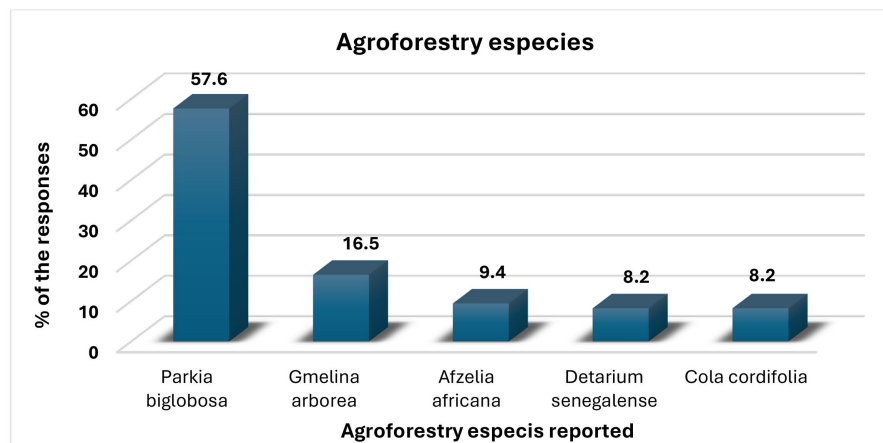


Figure 5. Distribution of conserved agroforestry tree species in the Sandéniah study area.

3.4. Reasons for Species Conservation

The reported reasons for conserving agroforestry species were commercial use (38.8%), food provision (35.3%), pharmaceutical/medicinal use (12.9%), and animal feed (12.9%) (**Figure 6**).

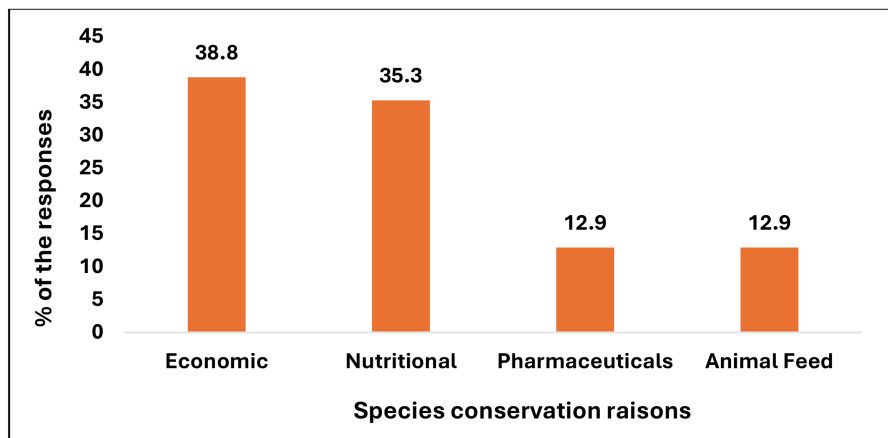


Figure 6. Reported reasons for the conservation of agroforestry tree species by local communities.

4. Discussion

The results indicate that agroforestry management in Sandéniah is closely connected to the livelihood functions of local production systems. Agriculture and livestock-related activities were frequently reported, while commercial use and food provision were the two most frequently cited reasons for conserving agroforestry species. This pattern suggests that conservation in the study area is not based solely on ecological considerations; it is also embedded in household eco-

conomic and subsistence needs. Recent syntheses of agroforestry evidence similarly emphasize the simultaneous livelihood and environmental functions of tree-based systems, while noting important trade-offs and context dependence (Castle et al., 2021; Muthee et al., 2022). Evidence from the Sahel further shows that extension access, training, and local information networks can influence the adoption and continued use of agroforestry practices (Grovermann et al., 2023). The management challenge is therefore to reconcile continued use of tree resources with practices that maintain the long-term availability of the species on which these livelihood benefits depend (Garrity, 2004).

The strong representation of *Parkia biglobosa* among conserved species is particularly informative. Its predominance is consistent with the multifunctional value attributed to the species in the Sudanian zone, where food, medicinal, and economic uses can provide direct incentives for retaining trees on agricultural land (Fandohan et al., 2010; Nyong et al., 2007). More broadly, the concentration of conservation around a limited number of economically or culturally important species suggests that local management is likely to favor species for which the benefits of retention are most visible to land users. Recent work in the Sudano-Saharan zone shows that tree and shrub effects on soil, crops, and livestock are strongly context-specific and argues for management approaches based on species mixtures rather than dependence on a single multipurpose species (Roessler et al., 2025). This perspective strengthens the interpretation that conservation planning in Sandéniah should retain valued species while also considering functional diversity. Similar observations have been reported in studies showing that farmers preferentially conserve tree species with high socioeconomic and cultural value (Teklehaimanot, 2004; Ramachandran Nair et al., 2010).

The most important result for understanding local agroforestry management is the statistically significant association between land tenure and the species conserved ($\chi^2 = 24.58$, $df = 12$, $p = 0.017$; Cramér's $V \approx 0.31$). This association indicates that species conservation is patterned according to land-access arrangements rather than being distributed independently of tenure status. The finding extends the customary-tenure literature by providing empirical evidence from Sandéniah that tenure arrangements are relevant to the composition of conserved agroforestry species. Recent studies from West and Central Africa reinforce the importance of tenure in agroforestry management: in Burkina Faso, parkland management differed according to farmers' social and land-tenure positions, while research in Cameroon showed that separated land and tree ownership can discourage agroforestry unless institutions align incentives and benefits (Zoungrana et al., 2023; Jaza Folefack & Darr, 2021). However, the cross-sectional design does not establish that tenure status directly causes conservation choices, and the sparse distribution of observations across several cells requires the chi-square result to be interpreted cautiously. Even with this limitation, the observed association is important because it suggests that interventions designed to conserve agroforestry species may be less effective when they treat farmers as a homogeneous group and

overlook differences in land-access arrangements.

The predominance of inheritance and gift as reported modes of land acquisition further supports the importance of customary and family-based tenure in the study area. Earlier research has shown that customary systems can contribute to natural-resource conservation when local rules and governance mechanisms are clear and respected (Gbetibouo, 2009; Cotula et al., 2004). More recent evidence shows that tenure conditions can either encourage or constrain long-term tree management depending on who owns land and trees, who controls management decisions, and how benefits are distributed (Jaza Folefack & Darr, 2021; Zoungrana et al., 2023). In Sandéniah, the significant tenure-species association therefore has a practical implication: agroforestry management measures should be linked to the local institutional context rather than implemented only through technical recommendations. Community agreements on tree retention, harvesting, regeneration, and protection could be incorporated into local land-use planning, with particular attention to the tenure situations in which conservation incentives may differ.

The findings also have direct implications for sustainable land management. Because agricultural production, livestock activities, and charcoal production are important components of local livelihoods, conservation measures that simply restrict resource use may be difficult to sustain. A more realistic approach would combine participatory land-use planning, farmer training, assisted natural regeneration, promotion of agroecological practices, and community-based rules for the management of retained trees. Recent West African research highlights tree-cover management and farmer-managed natural regeneration as practical pathways for restoring farm productivity and strengthening landscape resilience (Bayala & Harmand, 2023; Ahmad et al., 2021), while evidence from the Sahel indicates that extension services, training, and community information networks are important for agroforestry uptake (Grovermann et al., 2023). Current regional synthesis also emphasizes that sustainable parkland management requires integrating trees, crops, and livestock while accounting for species-specific trade-offs (Roessler et al., 2025; Meyfroidt et al., 2022). Extension and technical services should therefore focus not only on the adoption of practices, but also on strengthening local capacity to integrate tree conservation with agricultural production. At the policy level, the results support greater coordination between land-tenure governance, agricultural development, and natural-resource management rather than treating these areas as separate interventions.

This study contributes to current knowledge by linking household livelihood functions, species preferences, and land-tenure arrangements within a single empirical analysis of agroforestry management in Sandéniah, an area for which such evidence is limited. The significant relationship between tenure and conserved species is particularly relevant because it moves the discussion beyond a general description of species use toward a more institutional understanding of conservation behavior. This contribution is consistent with recent evidence showing that

agroforestry outcomes depend on interacting ecological, economic, informational, and institutional conditions rather than on tree planting alone (Muthee et al., 2022; Castle et al., 2021). The study therefore provides a local evidence base for designing management strategies that recognize both the economic value of agroforestry resources and the social organization of access to land. Future research should test whether the observed tenure-species relationship is reproduced with larger samples and across additional localities in Upper Guinea, examine the mechanisms linking specific tenure arrangements to tree-retention or regeneration decisions, and combine survey data with longitudinal field measurements of tree abundance, regeneration, harvesting intensity, and land-use change. Such studies would help distinguish association from causation and would provide stronger evidence for evaluating the effectiveness of tenure-sensitive agroforestry policies.

5. Conclusion

This study assessed the challenges associated with the sustainable management of agroforestry species in the Sandéniah District, Faranah Prefecture, Guinea, with particular attention to local uses, conservation practices, and land-tenure arrangements. The findings show that agroforestry management is closely connected to local livelihood needs, with commercial use and food provision being the main reported reasons for conserving the species identified. The significant association between land tenure and conserved species ($\chi^2 = 24.58$, $df = 12$, $p = 0.017$; Cramér's $V \approx 0.31$) is the principal analytical contribution of the study, indicating that conservation patterns differ across land-access arrangements. Because several expected frequencies were below five, this association should be interpreted cautiously and does not by itself establish a causal effect of tenure on conservation choices. For management and policy, the findings support tenure-sensitive interventions rather than uniform conservation measures. Local authorities and resource managers should incorporate agroforestry tree conservation into land-use planning and community land-management agreements; promote retention and assisted natural regeneration of priority agroforestry species on cultivated land; strengthen farmer and livestock-keeper training on tree management and regeneration; and support community rules governing tree harvesting, protection, and regeneration. Extension services should work with customary and local authorities so that these measures are compatible with prevailing land-access arrangements. These actions would help connect livelihood objectives with the conservation of agroforestry resources. The scientific contribution of this study lies in providing empirical evidence from Sandéniah that links species conservation patterns to the institutional context of land access, thereby extending the predominantly descriptive understanding of agroforestry management in the study area. The results provide a basis for further investigation of how tenure arrangements, livelihood incentives, and management practices interact to shape agroforestry conservation. Future studies should use larger and geographically broader sam-

ples, examine specific mechanisms linking tenure to tree-retention and regeneration decisions, and combine household surveys with longitudinal measurements of tree abundance, regeneration, harvesting, and land-use change. Such research would strengthen validation of the observed relationship and provide a stronger evidence base for tenure-sensitive agroforestry policies in Upper Guinea.

Acknowledgements

The authors express their sincere gratitude to the local communities of Sandéniah district for their active participation and willingness to share their knowledge and experiences during field data collection. The authors also acknowledge the support provided by local administrative authorities, technical services, and all stakeholders who facilitated access to the study area and contributed to the successful completion of this research. Special appreciation is extended to the institutions and collaborators involved in supporting the implementation of this study.

Author Contributions

Conceptualization: Alexandre KONATE, Lucie DUONAMOU. Methodology: Alexandre KONATE, Lucie DUONAMOU, Adama SIRIMA. Field Investigation and Data Collection: Alexandre KONATE, Apollinaire WEDJANGNON, Abdoulaye Aguibou DIALLO, Vamougnè KOUROUMA, Soua Julienne MOLMOU. Data Analysis and Interpretation: Alexandre KONATE, Lucie DUONAMOU, Delphine ADANDEDJAN. Writing - Original Draft Preparation: Alexandre KONATE. Writing - Review and Editing: Alexandre KONATE, Delphine ADANDEDJAN, Adama SIRIMA. Supervision: Lucie DUONAMOU. All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Ahmad, S., Caihong, Z., & Ekanayake, E. M. B. P. (2021). Livelihood Improvement through Agroforestry Compared to Conventional Farming System: Evidence from Northern Irrigated Plain, Pakistan. *Land*, 10, Article 645. <https://doi.org/10.3390/land10060645>
- Bayala, J., & Harmand, J. (2023). Managing Tree Cover to Restore Farm Productivity and Build Landscape and Livelihood Resilience in West Africa. *Agroforestry Systems*, 97, 1215-1220. <https://doi.org/10.1007/s10457-023-00878-4>
- Bernard, H. R. (2021). *Research Methods in Anthropology: Qualitative and Quantitative Approaches* (7th ed.). Rowman & Littlefield.
- Castle, S. E., Miller, D. C., Ordonez, P. J., Baylis, K., & Hughes, K. (2021). The Impacts of Agroforestry Interventions on Agricultural Productivity, Ecosystem Services, and Human Well-Being in Low- and Middle-Income Countries: A Systematic Review. *Campbell Systematic Reviews: Better Evidence for a Better World*, 17, e1167. <https://doi.org/10.1002/cl2.1167>
- Cotula, L., Toulmin, C., & Hesse, C. (2004). *Land Tenure and Administration in Africa*:

- Lessons of Experience and Emerging Issues*. International Institute for Environment and Development (IIED).
- Creswell, J. W., & Creswell, J. D. (2023). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (6th ed.). SAGE Publications.
- Fandohan, B., Assogbadjo, A. E., Kakai, R. G., Kyndt, T., Caluwé, E. D., Codjia, J. T. C. et al. (2010). Women's Traditional Knowledge, Use Value, and the Contribution of Tamarind (*Tamarindus indica* L.) to Rural Households' Cash Income in Benin. *Economic Botany*, 64, 248-259. <https://doi.org/10.1007/s12231-010-9123-2>
- FAO (2022). *The State of the World's Forests 2022: Forest Pathways for Green Recovery and Building Inclusive, Resilient and Sustainable Economies*. Food and Agriculture Organization of the United Nations, Rome.
- Fowler, F. J. (2014). *Survey Research Methods* (5th ed.). SAGE Publications.
- Garritty, D. P. (2004). Agroforestry and the Achievement of the Millennium Development Goals. In P. K. R. Nair, M. R. Rao, & L. E. Buck (Eds.), *New Vistas in Agroforestry* (pp. 5-17). Springer Netherlands. https://doi.org/10.1007/978-94-017-2424-1_1
- Gbetibouo, G. A. (2009). *Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability: The Case of the Limpopo Basin, South Africa*. IFPRI Discussion Paper No. 00849. International Food Policy Research Institute.
- Grovermann, C., Rees, C., Beyé, A., Wossen, T., Abdoulaye, T., & Cicek, H. (2023). Uptake of Agroforestry-Based Crop Management in the Semi-Arid Sahel—Analysis of Joint Decisions and Adoption Determinants. *Frontiers in Sustainable Food Systems*, 7, Article ID: 1042551. <https://doi.org/10.3389/fsufs.2023.1042551>
- Institut National de la Statistique (2017). *Recensement Général de la Population et de l'Habitation (RGPH-3)*. Institut National de la Statistique.
- IPCC (2019a). *Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*. Intergovernmental Panel on Climate Change.
- IPCC (2019b). Technical Summary. In P. R. Shukla et al. (Eds.), *Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems* (p. 36). Intergovernmental Panel on Climate Change.
- IPCC (2023). *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. IPCC.
- Jaza Folefack, A. J., & Darr, D. (2021). Promoting Cocoa Agroforestry under Conditions of Separated Ownership of Land and Trees: Strengthening Customary Tenure Institutions in Cameroon. *Land Use Policy*, 108, Article ID: 105524. <https://doi.org/10.1016/j.landusepol.2021.105524>
- Kumar, B. M., & Nair, P. K. R. (2011). *Carbon Sequestration Potential of Agroforestry Systems: Opportunities and Challenges*. Springer. <https://doi.org/10.1007/978-94-007-1630-8>
- Leakey, R. R. B. (2014). Agroforestry: A Delivery Mechanism for Multi-Functional Agriculture. *Agroforestry Systems*, 88, 165-175.
- Meyfroidt, P., de Bremond, A., Ryan, C. M., Archer, E., Aspinall, R., Chhabra, A. et al. (2022). Ten Facts about Land Systems for Sustainability. *Proceedings of the National Academy of Sciences of the United States of America*, 119, e2109217118. <https://doi.org/10.1073/pnas.2109217118>

- Ministère de l'Agriculture et de l'Élevage (2023). *Rapport Annuel des Statistiques Agricoles de la Guinée*. Ministère de l'Agriculture et de l'Élevage.
- Muthee, K., Duguma, L., Majale, C., Mucheru-Muna, M., Wainaina, P., & Minang, P. (2022). A Quantitative Appraisal of Selected Agroforestry Studies in the Sub-Saharan Africa. *Heliyon*, 8, e10670. <https://doi.org/10.1016/j.heliyon.2022.e10670>
- Nair, P. K. R., Kumar, B. M., & Nair, V. D. (2021). *An Introduction to Agroforestry: Four Decades of Scientific Developments*. Springer. <https://doi.org/10.1007/978-3-030-75358-0>
- Nyong, A., Adesina, F., & Osman Elasha, B. (2007). The Value of Indigenous Knowledge in Climate Change Mitigation and Adaptation Strategies in the African Sahel. *Mitigation and Adaptation Strategies for Global Change*, 12, 787-797. <https://doi.org/10.1007/s11027-007-9099-0>
- Ramachandran Nair, P. K., Nair, V. D., Mohan Kumar, B., & Showalter, J. M. (2010). Carbon Sequestration in Agroforestry Systems. *Advances in Agronomy*, 108, 237-307. [https://doi.org/10.1016/s0065-2113\(10\)08005-3](https://doi.org/10.1016/s0065-2113(10)08005-3)
- Roessler, R., Cicek, H., Cournac, L., Gnissien, M., Männle, J., Koomson, E. et al. (2025). Towards Transdisciplinary Identification of Suitable Woody Perennials for Resilient Agro-Silvopastoral Systems in the Sudano-Sahelian Zone of West Africa. *Agroforestry Systems*, 99, Article No. 26. <https://doi.org/10.1007/s10457-024-01113-4>
- Teklehaimanot, Z. (2004). Exploiting the Potential of Indigenous Agroforestry Trees: Parkia Biglobosa and Vitellaria Paradoxa in Sub-Saharan Africa. *Agroforestry Systems*, 61, 207-220. <https://doi.org/10.1023/b:agfo.0000029000.22293.d1>
- Zhou, X., Brandle, J. R., Awada, T. N., Schoeneberger, M. M., Martin, D. L., Xin, Y. et al. (2011). The Use of Forest-Derived Specific Gravity for the Conversion of Volume to Biomass for Open-Grown Trees on Agricultural Land. *Biomass and Bioenergy*, 35, 1721-1731. <https://doi.org/10.1016/j.biombioe.2011.01.019>
- Zoungrana, A., De Cannière, C., Cissé, M., Bationo, B. A., Traoré, S., & Visser, M. (2023). Does the Social Status of Farmers Determine the Sustainable Management of Agroforestry Parklands Located near Protected Areas in Burkina Faso (West Africa)? *Global Ecology and Conservation*, 44, e02476. <https://doi.org/10.1016/j.gecco.2023.e02476>