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Diversifying Land-Use Practices in Forest-Based Land Restitution Communities for Sustainable Development: Evidence from KwaZulu-Natal and Eastern Cape Provinces

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Abstract

The multifunctional use of the land has the potential to diversify opportunities for community beneficiaries of the land restitution program to accrue multiple benefits from their land. This study assessed the diversification of land-use practices in forest-based land-restitution communities' projects in KwaZulu-Natal and the Eastern Cape. Purposive sampling was used to select the four communities that benefited from the land restitution program. Using a semi-structured questionnaire, data were collected from 100 heads of households in each community. Descriptive statistics were used to summarize the data into percentages, while inferential statistical tests, including Multinomial Logistic Regression, assessed the independent socioeconomic factors influencing the perceived importance of forestry land-use practices, and Analysis of Covariance (ANCOVA) was used to determine the statistical differences between the importance of forestry and agricultural-based land-use practices. Friedman's mean ranking test analysis was performed to determine which land-use practice was ranked most important (1) and least important (10) using a 10-point Likert scale. The results showed that vegetables (1.64), followed by potatoes (2.62), maize (3.15) and beans (4.07), were the most common land-use practices. On the other hand, MLR results showed that male-dominated households were more likely to rate forestry land-use practices as highly important than as less or moderately important. Furthermore, the results indicate that highly educated heads of households were more likely to rate forestry land-use practices as highly important. This highlights that education and community participation are sustainable development strategies crucial to addressing inadequate forest management in rural communities and avoiding severe degradation of natural resources, while access to credit and extension services is also an important factor that could aid land-use diversification. Although the study's findings are limited by their context-specific nature, they offer a powerful localized diagnostic of coupled socioecological systems and provide an empirical basis for future national-scale or broader national-scale case studies, as well as confirmatory research employing population-proportional representative sampling. Such research would facilitate broader comparative analyses, strengthen the evidence base, and improve the understanding of the factors shaping the sustainability of forest-based land restitution projects. Nonetheless, our study's findings provide valuable information about the importance of various land-use types for sustainable economic and livelihood options in rural settings.

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Keywords: land-use practices; communal property association; community trust; sustainable development; multifunctional land use

1. Introduction

Since the dawn of democracy in South Africa, many rural communities have benefited from the land reform program, particularly the land restitution program [1]. Restitution is the program that was introduced by the first democratic administration to play a reforming and redressing role of the previous apartheid regime's land injustices [2], to permit Black communities or individuals whose land was dispossessed to claim full ownership. However, transitioning from a landless position to land ownership has created both opportunities and challenges for the community beneficiaries. On this note, the opportunities for land restitution lie in its clear objective of redressing past injustice and economically empowering those who suffered the impact of dispossession under the Natives Land Act of 1913 [3]. Land restitution focuses on restoring land rights or providing compensation to individuals and communities who can substantiate historical dispossession resulting from discriminatory legislation and policies. Land redistribution is a component of South Africa's land reform program aimed at providing historically disadvantaged Black individuals and communities with access to land, irrespective of whether they were directly dispossessed under apartheid. Beneficiaries are generally allocated land through leasehold arrangements, particularly for agricultural and arable land use [4]. On the contrary, it is widely recognized in the land reform literature in South Africa that the land restitution program's shortfall in achieving its desired outcomes has been due to a lack of technical capacity among beneficiaries to manage the acquired forestry plantations [5] and the governance relationship between the CPA committee and the traditional authority [6]. This has been exacerbated by the long-term nature of the forestry plantation cycle and the technical operations required to produce timber, necessitating the consideration of multifunctional land-use practices in the forest-based land restored to the beneficiaries [7].

The multifunctional use of land has the potential to diversify opportunities for community beneficiaries of the land restitution program to accrue multiple benefits from their land. Using different spatiotemporal analytical methodologies confirms a shift from a monocentric landscape to a polycentric structure, from homogeneous to heterogeneous land-use patterns. This aligns with arguments that establishing benefit-sharing mechanisms early can help limit potential conflicts that may jeopardize projects. It remains a critical challenge, as several forest-based land restitution projects have struggled to achieve the intended results. Studies in the Jessieville and Roburnia areas indicate that community beneficiaries have specific preferences regarding the structure of partnership agreements [8]. On the other hand, research has emphasized that the lease agreement model often failed to meet community expectations due to factors such as a lack of technical skills, limited finances, and institutional challenges. As highlighted in the literature, the claimant communities had an opportunity to settle their restitution claim on forestry industry commercial plantations to continue operating independently from the previous owners. In this case, the community beneficiaries are not obliged to lease back or enter into any partnership with the previous or potential investor. Nonetheless, the majority of the community beneficiaries of the forest-based land restitution projects continued to operate under government- and industry-conceptualized claim-settlement partnership models that lacked beneficiaries' contributions. Consequently, the dire challenge facing the majority of forest-based projects is the lack of post-settlement support from the government [9] or, in many cases, delays in the provision of such support in terms of finances, monitoring, and evaluation.

Considering that claimant communities are typically previously disadvantaged rural communities that require organization, land claim settlements generally involve establishing a communal property institution, such as a Communal Property Association or a Community Trust, to hold and manage the transferred land on behalf of the beneficiaries [10]. These community entities typically represent the beneficiaries in decision-making regarding land-use practices on their restituted land [10]. As noted in the literature, the multifunctional use of land is critical to improving socioeconomic benefits and people's livelihoods [11]. Hence, adopting multifunctional use of the restituted land in community projects provides an opportunity to diversify benefits and avoid continuing to focus solely on managing the monocultural forest plantation for timber production. The literature in forest-based land reform focused on evaluating the benefits of the land restitution to the beneficiaries [9,12] and effective benefit-sharing mechanisms [13], with limited in-depth analysis with regard to other land-use practices perceived as being critical to improving the livelihood and socioeconomic status of the community beneficiaries. This study is anchored in two theoretical frameworks, namely the socioecological systems (SES) framework [14] and Land Use Transition Theory (LUTT) [15].

LUTT provides a strong analytical perspective for this study's core research questions, postulating that communal land-use allocations undergo structural shifts as communities navigate the post-settlement phase, moving from forest-based land use (such as massive forest plantations for commercial timber production) toward diversified agricultural-based land-use practices to sustain household livelihoods and mitigate socioeconomic shocks (Figure 1). Additionally, to supplement the foundational core of these theoretical frameworks, this study drew on a locally based case study in which 'green-loop' and 'red-loop' dynamics were examined, with a focus on transitions between land uses [16]. As noted in the land change science, post-restitution communal plantation projects cannot be treated as discrete biophysical entities; rather, they represent highly coupled, institutionalized socioecological systems in which land-use choices are continuously negotiated in response to institutional governance rules, temporal dynamics, and actor traits [17]. This study aims to evaluate various potential land-use practices adopted by community beneficiaries in the four forest-based communal projects to increase land value and benefits. The significance of this study lies in its contribution to other important land-use strategies that community beneficiaries in South African forest-based land restitution projects could adopt to improve the sustainability of restituted lands and diversify economic benefits through short-term land-use practices.

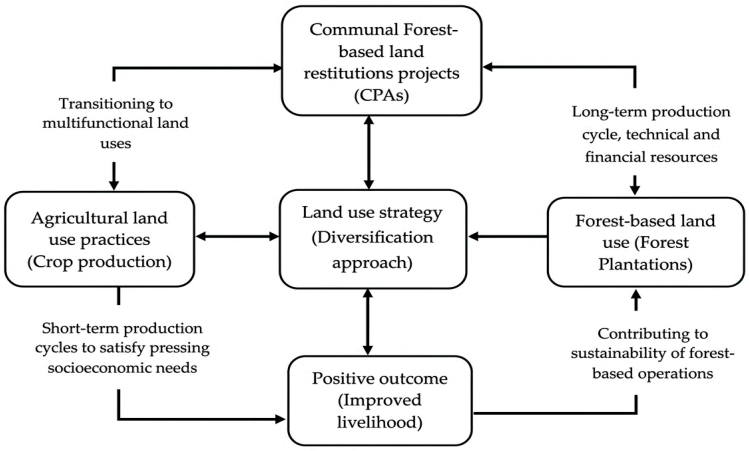


Figure 1. Conceptual framework depicting the relationship between land-use strategies in the communal forest-based land restitution projects to achieve positive livelihood outcomes and sustainability of forest-based operations.

2. Methodology

2.1. Study Area

This study was conducted in four communal small-scale forestry projects established under the land restitution program in KwaZulu-Natal and the Eastern Cape, respectively (Figure 2). These communal projects include the Mabandla in KZN located in the southern KwaZulu-Natal Province under the Umzimkulu Local Municipality at 30°15′45″ south and 29°55′15″ east, an administrative area in the Harry Gwala District, and enclaves between Kokstad in the West and Umzimkulu town in the East. According to communities in the Umzimkulu region, unemployment rates are high, with municipal rates estimated at 46.6% [18]. Furthermore, the Mabandla community is in the southern part of the Drakensberg Mountain at 30°15′ south and 29°15′ east, 30 km south of the 'fly fishing town', Underberg. In the Umzimkulu Local Municipality, about 90.8% of the population reside in rural areas, while the remaining 9.2% reside in semi-rural areas [19]. Additionally, the three Eastern Cape projects are the Mkhambati project in Flagstaff in the Eastern Pondoland region, the Sinawo plantation between Bizana and Port Edward in the Mbizana District Municipality, and the Ntywenka project, also known as Sixhotyeni, in the northeastern part of the province between the Maclear and Tsolo communities in the Elundini Local Municipality under Joe Gqabi District Municipality. Additionally, Ntywenka is strategically located near the PG Bison Board Mill at Ugie, whereas Sinawo is approximately 45 km from the Harding Treated Timber Pole plant at Harding. The proximity of the processing plants to these communal projects offers potential market opportunities, though realizing these requires addressing broader sector constraints [20].

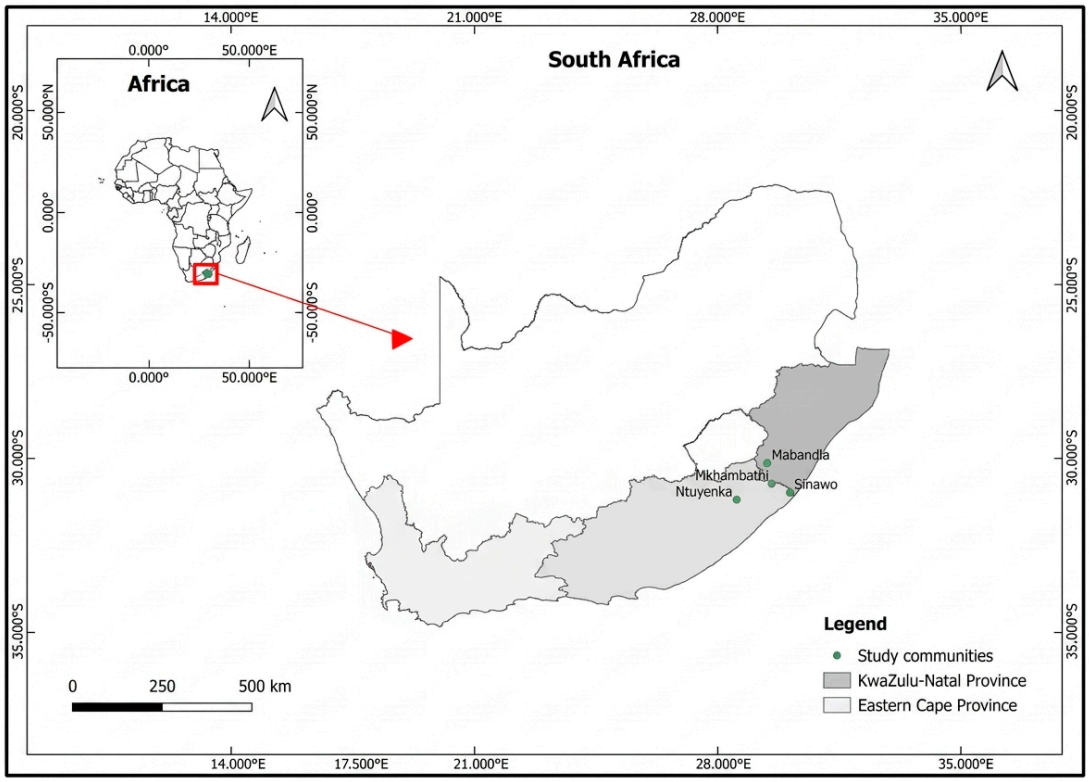


Figure 2. Map of South Africa showing the locations of the four study communities in the Province of KwaZulu-Natal and the Eastern Cape; map of Africa showing where South Africa is located.

2.2. Research Design and Sampling

This study adopted a mixed-methods research approach in which both quantitative and qualitative data were collected [21]. Purposive sampling was used to select key partici-

pants among the land claimant beneficiaries in each study community [22]. Furthermore, a pragmatic sampling design yielded a total of 400 households across four purposively selected communities that were managing forest-based land restitution projects under the CPA's landholding institutions. Notably, a standardized sample of 100 households in each study community was purposively drawn from the list of land claimant beneficiaries. This uniform threshold was selected due to the extreme remoteness and sparse distribution of households within each study community, which rendered strict probability-based or stratified random sampling logistically unfeasible and cost-prohibitive. A sample size of 100 households per community balances fieldwork feasibility with the statistical requirements necessary to maintain adequate precision for the subsequent regression models. This approach was adopted to ensure that only households that were among the claimant beneficiaries were selected for inclusion in the survey. This selection was not based on any mathematical formula, such as the population-proportional formula, and as a result, this presented a serious sampling limitation in this study. Nonetheless, the chosen sample size ensured sufficient statistical power for intra-community analysis while enabling comparisons between communities [23,24].

2.3. Data Collection

The household survey was conducted, and semi-structured questionnaires were administered to the heads of households to collect quantitative and qualitative data on land-use practices. The semi-structured questionnaire used in this study was designed to collect primary data from households in the selected study communities. The questionnaire comprised two main sections. The first section collected demographic and socioeconomic information, including respondents' age, gender, marital status, educational attainment, duration of project involvement, sources of income, and household income levels. The second section focused on questions about land-use competition and livelihood activities, aiming to understand the interactions between land-use practices and household livelihoods in the study area. To assess the importance of land-use practices to the households, a 10-point Likert-type scale question was used. The questionnaire was administered through face-to-face interviews targeting the heads of households, conducted by the researcher and the trained research assistants.

The surveyed households were randomly selected from the list of beneficiaries obtained from the Communal Property Association for each community project prior to the survey [25]. The randomization was achieved using an online random number table generator (https://stattrek.com/statistics/random-number-generator, accessed on 19 December 2019), which selects a random number, thereby eliminating bias. The seed value was set to none, and the minimum and maximum values were set to 1 and 100, respectively. However, due to the remoteness and sparse distribution of households in the study communities, convenience or purposive sampling was considered and employed. In addition, key informant interviews were conducted to gain an in-depth understanding of the different land use types within the communal projects in each region. The focus group discussion (FGD) was also conducted to gather more in-depth data on land-use practices that community beneficiaries incorporated into the management of their restituted land [26]. Ethical considerations were prioritized, and all necessary approvals were obtained (Ethical Research Committee Reference 2018/CAES/024). Participant consent was acquired, and participants were informed of their voluntary right to participate, which was critical to ethically protect the research and participants [27].

2.4. Data Analysis

The collected data were entered into Microsoft Excel and then transferred to the Statistical Package for the Social Sciences (SPSS) version 30 for organization, coding, error checks, and missing-data checks [28]. Furthermore, descriptive statistical analysis was performed to obtain frequencies and proportions. In addition, inferential statistical analysis was performed to assess the mean ranking using Friedman's mean ranking test [11]. This analysis was performed to identify the highest-ranked land-use practices as reported by community beneficiaries [11].

To perform a comparative analysis of the perceived land-use importance between commercial forestry and agriculture, a Quade's Non-parametric Analysis of Covariance (ANCOVA) was used on the 10-point Likert data. The duration of household involvement in the communal project (measured in years) was utilized as the continuous covariate. This approach was methodologically necessary because longer-standing project beneficiaries often exhibit statistically distinct land-use priorities compared to newer participants due to institutional familiarity and evolving benefit-sharing expectations. By ranking both the dependent variables and the covariate prior to linear residualization, Quade's test successfully isolates the true geographic variance between Mabandla, Mkhambathi, Sinawo, and Ntywenka, completely independent of individual household tenure dynamics. Given that there were nine independent food and cash-crop land-use practices, a computational variable-data transformation approach was used to compute the arithmetic mean of households' 10-point priority scores across all non-forestry crops, resulting in a single aggregated agricultural land-use practice. The aggregation was critical to developing a dual-sector analytical framework that includes both commercial forestry and general agriculture. This grouping of variables aligns with the mechanism of long-term forest plantation leases in South Africa, which facilitate the transfer of use rights to the private sector [11].

A multinomial logistic analysis was performed to determine the influence of independent variables on the dependent variable. The dependent variable in this MLR model was the forestry land-use practice, coded with three response levels: low importance = 1, neutral/moderately important = 2, and highly important = 3. To ensure that structural ambiguity is eliminated while maximizing the mathematical interpretability of the MLR, the three dependent-variable categories were systematically transformed into three ordinal ranking levels. These categories were transformed from 10-point-scale numerical boundaries and defined as low importance (1.00–4.99), medium importance (5.00–6.99), and high importance (7.00–10.00). Notably, the neutral/moderately important category's role was to capture central-tendency responses and also to act as a buffer zone. The highly important category was used as a reference in the regression analysis. The explanatory or predictor variables used in the model were gender (male = 1 and female = 2), age category (18–35 = 1, 36–59 = 2, 60 and above = 3), communal project (Mkhambathi = 1, Sinawo = 2, Ntywenka = 3, Mabandla = 4), education level (no education = 1, primary education = 2, secondary school = 3, tertiary education = 4) and duration of involvement in the communal project in years. Before performing the multinomial logistic regression analysis, multicollinearity diagnostics were conducted among the independent variables using the Variance Inflation Factor (VIF) thresholds. Assessing VIF is critical to ensure that high intercorrelations among predictor variables do not artificially inflate the standard errors of the regression coefficients or destabilize the computed odds ratios [29]. The analysis produced VIF values between 1.018 and 1.199, all safely below the conservative academic threshold of 5.0 [30]. This confirms the absence of severe multicollinearity and mathematically justifies the simultaneous inclusion of these socioeconomic predictors within the final regression model [31]. To analyze qualitative data collected in this study from key informants and focus group discussions, content and thematic analyses were performed

using the Qualitative Data Analysis Lite Miner software version 3.0.7 [32]. The data from the audio recorders was transcribed by the researcher with the research assistants and the transcribed data was then transferred into the QDA software to be processed into themes and coding of the themes.

3. Results

3.1. Household Respondents' Socioeconomic Profile

Table 1 presents the socioeconomic characteristics of head-of-household respondents in the study communities. Youth respondents were more represented in the Mkhambathi community project, accounting for 31%, followed by Sinawo (16%), Mabandla (9%), and Ntywenka (1%). At the same time, the findings indicate that the middle-aged group of 36–59 was more highly represented in the Ntywenka community (53%) compared to other community projects. Participation in the Mabandla community household respondents' survey among those aged 60 and above (elderly) was higher, accounting for 57%. As the results show, the three community projects, including Ntywenka, Mabandla, and Mkhambathi, had higher participation by male respondents, accounting for 69%, 64%, and 53%, respectively. Only in the Sinawo community did female respondents record higher participation, at 53% compared to 47% for male respondents. In the study communities, household structure was intact, with most household respondents married, comprising over 60%. Furthermore, the Sinawo community had more household respondents who were widows/widowers (27%), whereas the Mkhambati community had more single-household respondents (18%) across the four study communities. The most educated household respondents across the four communities were those from Mabandla, with 11% having a tertiary education and 52% having a secondary education. The results reveal that household respondents from Mkhambithi were leading, accounting for higher non-education levels (30%), followed by Ntywenka respondents at 16%, but leading in primary education holders (44%). Regarding household income, the Mabandla respondents led in three categories (i.e., ZAR 500-2000, ZAR 2000-5000, and more than ZAR 5000) compared to other communities, while the majority of household respondents in Ntywenka (59%) reported having no source of income. The chi-square result revealed that household respondents' socioeconomic characteristic responses across the four study communities, including age ($X^2 = 53.192$; $p = 0.001$), gender ($X^2 = 12.449$; $p = 0.006$), marital status ($X^2 = 33.110$; $p = 0.001$) and education level ($X^2 = 45.242$; $p = 0.001$), were all statistically significantly related, while there was no statistically significant relationship regarding household income ($X^2 = 16.054$; $p = 0.167$).

3.2. Ranking of Household Importance of Land-Use Practices

Table 2 presents the household-level ranking of the importance of land-use practices. Heads of households ranked vegetables (1.64) as the most important land-use practice, followed by potatoes (2.62), maize (3.15), and beans (4.07). On the other hand, heads of households ranked forestry (5.90) slightly higher than horticultural (6.40) land-use practice (fruit production), suggesting that households preferred some agricultural-based land-use practice more than forestry. Notably, the results showed a statistically significant difference in land-use practices ($X^2 = 2459.148$, df = 9, $p = 0.001$). At the same time, cotton, tea, groundnuts, and wheat were ranked as the least important land-use practices. Furthermore, the pairwise comparison results revealed no statistically significant differences in the distributions of six land-use pairs ($p > 0.05$), whereas 39 land-use pairs showed statistically significant differences ($p < 0.05$) (Table 3).

Table 1. Socioeconomic profile of the household respondents in the study communities.

Categories	Proportions (%) of Household Respondents per Project				Inferential Statistics		
	Mkhambathi $N = 100$	Sinawo $N = 100$	Ntywenka $N = 100$	Mabandla $N = 100$	X^2	df	*p*-Value
Age							
18–35	31	16	1	9	53.192	6	0.000 *
36–59	19	30	53	34			
60 and above	50	54	46	57			
Gender							
Male	53	47	69	64	12.449	3	0.006 *
Female	47	53	31	36			
Marital Status							
Married	63	60	81	86	33.110	6	0.000 *
Widow/Widower	19	27	17	7			
Single	18	13	2	7			
Education Level							
NE	30	8	16	1	45.242	9	0.000 *
PE	31	42	44	36			
SE	34	44	34	52			
TE	5	6	6	11			
Household income							
Less than ZAR 500	1	2	2	0	16.054	12	0.167
ZAR 500-2000	46	44	26	49			
ZAR 2000-5000	16	17	12	20			
More than ZAR 5000	4	9	3	14			
No income	33	28	59	17			

* Signifies statistically significant relationship of the responses at 0.05, NE: No Education, PE: Primary Education, SE: Secondary Education, TE: Tertiary Education.

Table 2. Household respondents' land use option preference rankings.

Land Use	Mean Rank	Inferential Statistics		
		X^2	df	*p*-Value
Forestry	5.90 [5]	2459.148	9	0.001 *
Maize	3.15 [3]			
Beans	4.07 [4]			
Potatoes	2.62 [2]			
Vegetables	1.64 [1]			
Fruits	6.40 [6]			
Cotton	9.28 [10]			
Wheat	7.04 [7]			
Tea	7.58 [9]			
Groundnuts	7.32 [8]			

* signifies significant difference at 0.05. 1 = most important–10 = less important.

3.3. Perceived Importance of Forestry and Agricultural Land-Use Practices

The post hoc pairwise comparison analysis was conducted using Tukey's HSD test to assess statistically significant differences in the perceived importance of commercial forestry and agricultural land-use practices (Table 4). The adjusted rank residuals indicated similarities in prioritization across the four study communities. The results clearly indicate a statistically significant difference between the Mkhambathi and Sinawo communities, showing that households in Mkhambathi prefer forestry land use significantly more than those from the Sinawo community (mean difference = 101.00, Std. Error = 14.39, $p < 0.001$). On the contrary, the agricultural land use model shows a statistically significant difference be-

tween Sinawo and Mkhambathi (Mean difference = −121.39, Std. Error = 14.93, $p < 0.001$), indicating that households in the Sinawo community prioritize agricultural land-use practices to a significantly greater extent than those in Mkhambathi. Furthermore, the results reveal no statistically significant difference between Mkhambathi and the Mabandla (mean difference = 17.92, Std. Error = 14.39, $p = 0.599$) or the Ntywenka communities (mean difference = −23.46, Std. Error = 14.39, $p = 0.363$). On the other hand, Mabandla and Ntywenka showed similarities in the household-perceived importance of agricultural land-use practices, with a mean difference of −12.89, Std. Error = 14.93 and $p = 0.084$. Conversely, the Ntywenka community showed a significantly higher prioritization of forestry land-use practices (mean difference = 41.38, Std. Error = 14.39, $p = 0.022$) than the Mabandla community. Although forestry land-use practices exist in Mabandla, Ntywenka, and Sinawo, the findings indicate that Mkhambathi's conditions are exceptionally favorable for promoting such practices compared with those in Sinawo.

Table 3. Friedman's test ranking pairwise comparison.

Sample 1	Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
Vegetables	Potatoes	0.981	0.214	4.583	<0.001	0.000
	Maize	1.511	0.214	7.059	<0.001	0.000
	Beans	2.426	0.214	11.333	<0.001	0.000
	Forestry	4.260	0.214	19.898	<0.001	0.000
	Fruits	−4.756	0.214	−22.216	<0.001	0.000
	Wheat	−5.401	0.214	−25.229	<0.001	0.000
	Groundnuts	−5.684	0.214	−26.549	<0.001	0.000
	Tea	−5.943	0.214	−27.757	<0.001	0.000
	Cotton	−7.638	0.214	−35.675	<0.001	0.000
Potatoes	Maize	0.530	0.214	2.476	0.013	0.599
	Bea	1.445	0.214	6.750	<0.001	0.000
	Forestry	3.279	0.214	15.315	<0.001	0.000
	Fruits	−3.775	0.214	−17.633	<0.001	0.000
	Wheat	−4.420	0.214	−20.646	<0.001	0.000
	Groundnuts	−4.703	0.214	−21.965	<0.001	0.000
	Tea	−4.961	0.214	−23.174	<0.001	0.000
	Cotton	−6.656	0.214	−31.091	<0.001	0.000
Maize	Beans	−0.915	0.214	−4.274	<0.001	0.001
	Forestry	2.749	0.214	12.839	<0.001	0.000
	Fruits	−3.245	0.214	−15.157	<0.001	0.000
	Wheat	−3.890	0.214	−18.170	<0.001	0.000
	Groundnuts	−4.173	0.214	−19.490	<0.001	0.000
	Tea	−4.431	0.214	−20.698	<0.001	0.000
	Cotton	−6.126	0.214	−28.616	<0.001	0.000
Beans	Forestry	1.834	0.214	8.565	<0.001	0.000
	Fruits	−2.330	0.214	−10.883	<0.001	0.000
	Wheat	−2.975	0.214	−13.896	<0.001	0.000
	Groundnuts	−3.258	0.214	−15.216	<0.001	0.000
	Tea	−3.516	0.214	−16.424	<0.001	0.000
	Cotton	−5.211	0.214	−24.342	<0.001	0.000
Forestry	Fruits	−0.496	0.214	−2.318	0.020	0.920
	Wheat	−1.141	0.214	−5.331	<0.001	0.000
	Groundnuts	−1.424	0.214	−6.650	<0.001	0.000
	Tea	−1.683	0.214	−7.859	<0.001	0.000
	Cotton	−3.378	0.214	−15.776	<0.001	0.000

Table 3. *Cont.*

Sample 1	Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
Fruits	Wheat	−0.645	0.214	−3.013	0.003	0.116
	Groundnuts	−0.928	0.214	−4.332	<0.001	0.001
	Tea	−1.186	0.214	−5.541	<0.001	0.000
	Cotton	−2.881	0.214	−13.458	<0.001	0.000
Wheat	Groundnuts	−0.283	0.214	−1.320	0.187	1.000
	Tea	−0.541	0.214	−2.528	0.011	0.516
	Cotton	2.236	0.214	10.446	<0.001	0.000
Groundnuts	Tea	0.259	0.214	1.209	0.227	1.000
	Cotton	1.954	0.214	9.126	<0.001	0.000
Tea	Cotton	1.695	0.214	7.917	<0.001	0.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (two-sided tests) are displayed. The significance level is 0.050. Significance values have been adjusted by Bonferroni correction for multiple tests.

Table 4. ANCOVA post hoc pairwise comparison of commercial forestry and agricultural land-use practice importance.

(I) Project	(J) Project	Commercial Forestry Land -Use Practice Model			Agricultural Land-Use Practice Model		
		Mean Difference (I–J)	Std. Error	Sig.	Mean Difference (I–J)	Std. Error	Sig.
Mkhambathi	Sinawo	101.00 *	14.39	<0.001	−121.39 *	14.93	<0.001
	Ntywenka	−23.46	14.39	0.363	−47.26 *	14.93	0.009
	Mabandla	17.92	14.39	0.599	−60.15 *	14.93	<0.001
Sinawo	Mkhambathi	−101.00 *	14.39	<0.001	121.39 *	14.93	<0.001
	Ntywenka	−124.46 *	14.39	<0.001	74.13 *	14.93	<0.001
	Mabandla	−83.09 *	14.39	<0.001	61.24 *	14.93	<0.001
Ntywenka	Mkhambathi	23.46	14.39	0.363	47.26 *	14.93	0.009
	Sinawo	124.46 *	14.39	<0.001	−74.13 *	14.93	<0.001
	Mabandla	41.38 *	14.39	0.022	−12.89	14.93	0.824
Mabandla	Mkhambathi	−17.92	14.39	0.599	60.15 *	14.93	<0.001
	Sinawo	83.09 *	14.39	<0.001	−61.24 *	14.93	<0.001
	Ntywenka	−41.38 *	14.39	0.022	12.89	14.93	0.824

* This shows that the mean difference is statistically significant at the 0.05 level. It is important to note that both models statistically control for the covariate, which is the duration of household involvement in the communal project in years. At the same time, the values for the agriculture model represent the rescaled raw rank residual.

3.4. Household Factors Influencing Prioritization of Forestry Land-Use Practice Importance

The overall model demonstrated a strong and statistically significant fit to the data (Table 5). A likelihood ratio test revealed that the final model, which included the independent variables, was a highly significant improvement over the baseline intercept-only model, X^2 (20) = 124.129, $p < 0.001$. This significant improvement is reflected in a substantial reduction of the model error, with the −2 Log Likelihood dropping from 468.313 to 344.184. Furthermore, evaluation of the pseudo R^2 values indicated a good effect size; the independent variables accounted for an estimated 26.7% (Cox and Snell R^2) to 30.3% (Nagelkerke R^2) of the variance in the dependent variable, while the McFadden R^2 value of 0.146 confirmed a moderate and acceptable model fit.

Table 5. Model fitting information and pseudo R-squared statistics.

Metric	Value
Model Fitting Criteria	
Intercept Only −2 Log Likelihood	468.313
Final Model −2 Log Likelihood	344.184
Likelihood Ratio Tests	
Chi-square (X^2)	124.129
Degrees of Freedom (df)	20
Significance (p)	<0.001
Pseudo R^2 Measures	
Cox and Snell R^2	0.267
Nagelkerke R^2	0.303
McFadden R^2	0.146

Table 6 presents the multinomial logistic regression analysis, in which household socioeconomic factors were used as predictors of the importance of forestry land-use practices. The odds ratio for the Sinawo community is 6.486 (B = 1.870, df = 1, $p = 0.001$), indicating that heads of households in this community are 548.6% more likely to perceive forestry land-use practices as having low importance than those in the Mabandla community. The results further show that households in the Ntywenka community (0.256, $p = 0.002$; 0.439, $p = 0.019$) had 74.4% and 56% lower odds of prioritizing commercial forestry land-use practices than those households in Mabandla. The duration of involvement was less likely to influence heads of households' decisions to consider forestry land-use practices as highly important. The 36–59 age category was significantly more likely to prioritize commercial forestry land-use practices as being highly important than the 66 and above age category (B = 0.771, Std. df = 1, $p = 0.017$). The odds ratio for Mkhambathi is 0.436 ($p < 0.05$), indicating that heads of households in this community have 56.4% lower odds of prioritizing commercial forestry land use than those in Mabandla.

Table 6. Household socioeconomic predictors influencing the importance of forestry land-use practices.

Forestry Land-Use Practice [a]	Predictors	B	Std. Error	df	Sig.	Exp (B)	95% Confidence Interval for Exp (B)	
							Lower Bound	Upper Bound
Low importance	Duration of Involvement	−0.194	0.125	1	0.120	0.824	0.645	1.052
	Mkhambathi	−0.097	0.396	1	0.806	0.907	0.418	1.971
	Sinawo	1.870	0.377	1	<0.001	6.486	3.095	13.592
	Ntywenka	−1.361	0.446	1	0.002	0.256	0.107	0.615
	18–35	0.744	0.401	1	0.064	2.104	0.958	4.618
	36–59	0.771	0.324	1	0.017	2.161	1.146	4.078
	Male	−0.238	0.269	1	0.376	0.788	0.465	1.336
	No education	0.018	0.649	1	0.978	1.018	0.285	3.635
	Primary education	−0.521	0.553	1	0.346	0.594	0.201	1.755
	Secondary education	−0.329	0.529	1	0.534	0.720	0.255	2.029
Neutral/Moderately important	Duration of Involvement	−0.041	0.140	1	0.768	0.960	0.729	1.263
	Mkhambathi	−0.831	0.399	1	0.037	0.436	0.199	0.953
	Sinawo	−0.769	0.489	1	0.116	0.464	0.178	1.209
	Ntywenka	−0.823	0.351	1	0.019	0.439	0.221	0.873
	18–35	−0.066	0.513	1	0.898	0.936	0.343	2.558
	36–59	0.438	0.314	1	0.164	1.549	0.837	2.869
	Male	−0.205	0.276	1	0.459	0.815	0.474	1.401
	No education	0.555	0.685	1	0.418	1.743	0.455	6.673
	Primary education	0.310	0.591	1	0.600	1.364	0.428	4.345
	Secondary education	−0.240	0.583	1	0.680	0.786	0.251	2.467

a. The reference category is highly important.

The results show that with all other factors held constant, Sinawo community heads of households are significantly more likely (B = 1.870, df = 1, $p = 0.001$) to indicate that forestry land-use practices are of lower importance than those from the Mabandla community. On the other hand, heads of households from the Ntywenka community were less likely (B = −1.361, df = 1, $p = 0.002$) to indicate that forestry land-use practice is of lower importance to them than those from the Mabandla community. The MLR results show that male heads of households' odds ratios are below 1, indicating that they are 0.788 and 0.815 times less likely than female heads of households to perceive forestry land-use practices as having either low or moderate importance. The duration of households' involvement in the communal project had no significant influence on their perception of the importance of forestry land-use practice, indicating that increasing the duration of involvement with one unit in years is unlikely to change households' perception of the low or moderate importance of forestry land-use practice in their communal project.

4. Discussion

4.1. Importance of Different Land-Use Practices

Several agriculture-based land-use practices are considered more important for subsistence economies compared to forestry in many rural settings. As suggested by Ref. [33], shifting from a monocentric to a polycentric landscape structure is crucial. This clearly calls for prioritizing various agricultural crops, as their production cycles are shorter than those of forestry. However, due to its long-term nature, forestry land-use practices take several years to generate income and require substantial infrastructure investment [34]. As noted by Refs. [11,12], many forest-based land reform initiatives, or even general community projects, require the capacity for successful implementation and sustainability. On this note, Ref. [6] argued that differences experienced between the traditional authority and CPA committee members are the primary drivers of the land restitution project's success, rather than capacity issues. Hence, considering multifunctional land-use practices that incorporate agriculture-based activities to complement forestry plantation and production management is of paramount importance [35]. Previous studies have also shown that using the landscape in a multifunctional approach enables local people to expand their socioeconomic benefits or improve their livelihoods [36]. In many instances, the trend shows that most people adopt agroforestry systems to maximize their chances of drawing various land resource benefits [37]. This is to avoid focusing on a single land-use practice, which, if it fails to sustain itself, will significantly compromise livelihoods [36]. This argument aligns with the assertions by Ref. [38], who stressed that the implementation of agroforestry land-use practices in rural settings not only contributes to increasing food production but also provides a significant option to create employment opportunities. In this case, the study community's preference for different cash-crop land-use practices could be attributed to their rural setting, characterized by poverty, which compels them to seek alternative livelihood-improvement solutions, such as forest product extraction [39]. As noted by Ref. [40], there is a significant need to ensure that reservation of the land for diversified land-use practices to sustain the economic benefits and livelihood of the local people or land claimants is prioritized. Furthermore, according to Ref. [41], it is critical to note that access to credit and extension services are important factors for diversifying the land-use practices.

4.2. Importance of Forestry and Agricultural Land-Use Practices

The perceived importance of forestry land-use practice differed significantly between the heads of households of the four community projects. This distinction could be aligned with the ecological conditions of the study communities, which may have shaped each household's perception of the relative importance of forestry and agricultural land-use practice.

Furthermore, the findings showed no statistically significant difference in the importance of their forestry- and agriculture-based land-use practices, except between the two communities, Mkhambathi and Sinawo. This perceived difference between the two communities could be mainly due to the heads of households' understanding and appreciation of local environmental conditions. Hence, the Mkhambathi heads of households demonstrated that forestry-based land-use practice was highly important. For the Mkhambathi community, forestry land use was identified as the most promoted or economically beneficial, whereas for the Sinawo community, agriculture-based land-use practices dominated. As pointed out in the study by Ref. [42], it is clear that various noticeable factors significantly contribute to the decision-making process regarding the importance of specific land-use practices. The importance of forestry land-use practices was perceived equally by the Mabandla and Ntyweka communities, possibly due to their proximity to timber-processing plants. For instance, the Mabandla community forest-based project has long been associated with a management model that incorporated primary production (tree growing and tending) and processing (a smallholder sawmilling business or enterprise). Most importantly, the Mabandla community had a strong partnership with external stakeholders that supported them in forestry-related operations and management across the entire value chain. Similarly, the findings of one study [11] confirm that the diversification of land uses from a single forestry-based practice by the Cata CPA greatly contributed to supplementary benefits from agriculture-based and tourism-based projects and the enhancement of socioeconomic benefits. This diversification has the potential to encourage local people to continue to view forestry as an important option since they would be deriving benefits from alternative, short-term, rewarding land uses while waiting to benefit from sustainable forestry-based land use. The Mabandla project also benefited from the expertise of private industry and/or individual foresters in setting up forest-based operations, thereby generating income for the CPA and empowering beneficiaries by providing employment opportunities [43]. This is in line with the assertion that access to credit and extension services enhances the positive impact of commercial forest plantations on communities [44]. The authors of one study conducted in Loas [40] presented a different view, stating that commercial forestry plantation management tends to drive displacement and marginalize the local community members, which often occurs in these settings. This argument is supported by a study [6] that suggests that South African community forestry development efforts are limited by the traditional authority's dictatorial tendencies.

4.3. Factors Influencing the Importance of Forestry Land-Use Practice

It is important to understand the household socioeconomic factors that influence the perceived importance of forestry-based land-use practices. This argument aligns with the authors of Ref. [45], who posit that future studies examining the socioeconomic factors influencing urban growth at finer multi-agent spatial scales are crucial. However, it is clear that the patriarchal structure further exacerbates gender inequalities, as men are traditionally regarded as the primary economic providers within households and are therefore expected to assume responsibility for supporting their families [46]. Another element could be that commercial forestry plantation land-use practices are often considered to be male-dominated, as women's access to land and trees is frequently mediated through their relationships with men [47]. In this regard, women often find themselves marginalized or facing barriers that exclude them from participating in forest management activities [48]. Several studies confirm that females in many rural communities are in a compromised position regarding their land tenure rights and participation in decision-making structures [49,50]. This is largely attributed to the patriarchal structure of many rural communities, which often perpetuates cultural norms that limit women's participation and engagement in commercial

forest-based activities [50]. Consequently, forest plantation activities are widely regarded as physically demanding, a misconception that continues to reinforce gender-based stereotypes and biases concerning women's capabilities in undertaking such work.

According to Ref. [51], education and community participation stand as sustainable development strategies that are crucial to addressing inadequate forest management in rural communities and avoiding severe degradation of natural resources. Additionally, other authors posited that education provides household members with mechanisms to cope with and to implement varied livelihood options to improve their lives [52]. This is also consistent with the study by Ref. [53], which focused on education, vulnerability, and resilience after natural disasters, suggesting that household members with a higher education were able to maintain their consumption after a tsunami. This affirms the influence of education in the decision-making process. Equally, Ref. [54] agrees that education is vital for understanding and interpreting relevant information. This underscores the importance of household members enhancing their educational status, as this directly complements decision-making within their household. This argument is in support of Ref. [45], which emphasizes the significance of proactive planning and management strategies in the landscape.

5. Conclusions

The findings of this study have revealed that households in the study communities were interested in pursuing multifunctional land-use practices to supplement forestry-based land-use practices. However, the findings further confirmed the importance of forestry-based land-use practices, which are dominated by male heads of households. These findings affirm the necessity of promoting the greater involvement of women in commercial forestry plantation land-use practices in South Africa to foster gender equity and support transformative outcomes in communal forest-based projects. At the same time, education has proven to be the most important socioeconomic factor to consider in ensuring that sustainable forest- and agriculture-based land-use practices are underpinned by effective decision-making. Evidently, education and community participation stand as sustainable development strategies crucial to addressing inadequate forest management in the rural communities and avoiding severe degradation of natural resources, while access to credit and extension services are also important factors that aid land-use diversification. Hence, it would be vital to prioritize programs that support households' capacity-building structures to help them navigate the challenges of land-use transitions. Furthermore, a limitation of this study is that its findings are context-specific and may not be readily generalizable to other settings. Nevertheless, this study provides a valuable, localized assessment of socioecological systems and offers an empirical foundation for future research, including broader regional or national-scale studies and confirmatory investigations employing population-proportional representative sampling techniques. Such research would facilitate broader comparative analyses, strengthen the evidence base, and improve the understanding of the factors shaping the sustainability of forest-based land restitution projects. Nonetheless, our findings provide valuable information about the importance of various land-use practices for sustainable economic and livelihood options in rural settings.

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Abbreviations

The following abbreviations are used in this manuscript:

CPA	Communal Property Association
CT	Community Trust
KZN	KwaZulu-Natal
ANCOVA	Analysis of Covariance
QDA	Qualitative Data Analysis
FGD	Focus Group Discussion
VIF	Variance Inflation Factor
MLR	Multinomial Logistic Regression
LUTT	Land Use Transition Theory
SES	Socioecological Systems

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