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Adaptation to land scarcity among small-scale farming households in South Kivu in the Democratic Republic of the Congo

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Rural farming households in Sub-Saharan Africa, facing limited land access, engage in land purchase, rental, and other land access practices. However, the highly unregulated land markets expose these farmers to wide-ranging vulnerabilities. In this study, we investigated the land access mechanisms and the related constraints among the small-scale farmers in the densely populated Eastern part of The Democratic Republic of the Congo (DRC). We randomly selected 240 consenting farmers for inclusion in the study and collected data using semi-structured interviews to obtain data on land access characteristics. Then, the data was subjected to descriptive statistics to obtain measures of central tendency and dispersion on the responses and correlation statistics to understand the patterns and relations of factors affecting the land access and strategies used to cope with the limited land situation in the South Kivu province of DRC. Our results showed an insecure land tenure system among smallholder farmers. Most of the farmers in the study purchased and leased land to cope with poor land access and, in so doing, faced high price-related limitations that were unsustainable to these farmers; they also faced highly restrictive leasehold contracts. Given the limited access to financial resources and support, improving regulations of land markets and resource support interventions could promote land access among these smallholder farmers. We conclude that the challenges of land access and the current methods farmers use to obtain additional land among the smallholder farming households in the south Kivu province of DRC are precarious and unsustainable and continue to pose a food insecurity and poverty risk among these farmers. We recommend developing and implementing measures to support resource access by these farmers, such as finance, farmer-focused cooperative societies, and better land policy reforms and tenure systems to improve access to land among these farmers and farmers facing similar scenarios in other parts of sub-Saharan Africa.

KEYWORDS

smallholder farmers, land access, land markets, leasehold restrictions, rural households, food security

Introduction

High population densities are typical of rural farming communities in Africa (Rosell et al., 2017; Bashangwa Mpozi et al., 2020) and are linked to large household sizes and high birth rates among these communities (Bashangwa Mpozi et al., 2020; Makali et al., 2021). The high population growth observed in these rural communities creates pressure on land resources and results in widespread land fragmentation (Headey and Jayne, 2014; Jayne et al., 2016; Bashangwa Mpozi et al., 2020), which negatively impacts agricultural production due to associated production inefficiencies. Given that most of the population in these rural regions are subsistence farmers, they also have challenges acquiring more land resources because they do not have other sources of income to support this. However, such communities can benefit from land use policies to improve land access for agricultural practices in rural areas. As such, Governments develop and implement land use policies that regulate land use and address land access, among other land use challenges (Musahara and Huggins, 2004; Ndip et al., 2023).

There were high population densities in the eastern parts of the DRC (Headey and Jayne, 2014; INS, 2019; Angélique et al., 2022), especially in North Kivu and South Kivu provinces, two of the 26 provinces of DRC located in the Eastern part of the country (INS, 2019, 2021). As of 2020, North Kivu, with a land area of 59,483 km^2 and a population of 7,574,000 people, translated to a population density of 127 inhabitants/km^2, while South Kivu, with a land area of 64,791 km^2 and a population of 6,565,000 people, translated to a population density of 101 inhabitants/km^2, compared to the country's average of 42 inhabitants/km^2 (INS, 2021). In particular, the population of South Kivu tripled to reach 6,157,000 people in three decades (1984–2017), indicating a very high population growth rate (INS, 2019). About three-quarters of the South Kivu population is rural and mainly depends on agriculture (World Bank Group, 2018; Nabintu et al., 2020; Makali et al., 2021). Therefore, the high population density contributes to limited access to land resources for agricultural and other uses. Furthermore, the situation is more complex because of regional and local conflicts that result in the displacement of people in both North and South Kivu provinces of DRC (Musahara and Huggins, 2004; Van Acker, 2005; Alinovi et al., 2008; Chamberlin et al., 2014; Bashangwa Mpozi et al., 2020).

The context of land access and ownership in the Eastern part of DRC, such as the province of South Kivu, is very variable; there are some large-scale landowners with access to large tracks of land; however, the majority of the rural farmers have insecure and limited access to land (Van Acker, 2005; Eurac, 2017; Mugumaarhahama et al., 2021). The land access situation of these rural farmers is caused by the limited land resources shared by a large population (INS, 2019, 2021), high population growth due to the high birth rate (Mathe et al., 2011), and the prevalence of conflicts and wars that contribute to displacement of people from their land (Van Acker, 2005; Alinovi et al., 2008; Huggins, 2010). These scenarios have resulted in the prevalence of poverty and food insecurity among most of the population (Alinovi et al., 2008; World Bank Group, 2018). The rural farmers in these regions are also resource-poor and cannot afford some of the critical farm production inputs, resulting in poor crop yields (Nabintu et al., 2020). The other issues surrounding land access and availability to the smallholder farmers in DRC include land-grabbing practices by the elites, poor protection for small-scale farmers from land-grabbing practices, and land use conflicts arising from the acquisition of rural land for mining and other commercial activities (Van Acker, 2005; Geenen and Claessens, 2013; Geenen and Hönke, 2014; Pottek et al., 2017).

Lack of land ownership security among most rural farmers and poor policy scenarios in DRC could have encouraged land-grabbing practices (Nyenyezi and Ansoms, 2014; Pottek et al., 2017). Furthermore, there was insufficient regulation of customary mechanisms of land acquisition, such as land inheritance (Oyono, 2011). In particular, the Congolese land legislation did not have a clear policy on customary land ownership. Initially, the land was substantially community-owned and used by communities as a shared resource for community members; however, over time, land ownership was privatised (Reyntjens, 2005; Oyono, 2011; Abay et al., 2021). At the community and family levels, the customary laws on inheritance in sub-Saharan Africa supported land inheritance mostly among men and in some cases, eldest sons could get larger shares; on the other hand, women accessed land through their male relatives (Pottier, 2007; Kalabamu, 2009; Gibson and Gurmu, 2011). However, the ongoing socioeconomic changes have increased women's access to land in most of sub-Saharan Africa, including the DRC (Cooper, 2010; Syn and Mastaki, 2015). The changes have enabled more land access to women through traditional forms such as inheritance and non-traditional ways, including land purchase and rentals (Mathe et al., 2011; Cooper, 2012; Peterman, 2012; Syn and Mastaki, 2015).

Recently, the DRC enacted a land reform in 2012 to promote access to land resources among smallholder farmers through improving land governance. Key elements of this reform were limiting or eradicating land conflicts and land-related violence arising from misappropriation, unfair allocation, and unlawful land acquisition and land-grabbing practices. However, the land access challenge among these farmers was still widespread. Unfortunately, poor policies traditionally favoured the elites who, in some cases, unlawfully acquired and controlled the land resources; as such, the elites and administrative authority were reluctant to implement land policy reforms (Eurac, 2017). The Congolese socio-political context also did not support the reforms (Ngalamulume, 2016).

In a recent study, poor land access among smallholder farmers has been described as a critical impediment to poverty elimination in the south Kivu province of Eastern DRC (Angélique et al., 2022). Other studies have also reported limited access to land as a significant constraint facing small-scale farming households in rural sub-Saharan Africa (Bashangwa Mpozi et al., 2020; Ndip et al., 2023). However, evidence from Kenya indicates that alternative forms of land access, such as leasing, can improve agricultural production and the income of land-constrained small-scale farmers (Jin and Jayne, 2013). In the case of South Kivu, these small-scale farmers also face poor access to alternative sources of finance (Mulume Bonnke et al., 2022); therefore, they are resource-constrained and may lack the capacity to participate equally in land purchase and rental markets. As such, the objective of this study was to examine how the resource-poor small-scale farming households of Eastern DRC deal with limited access to agricultural land and to evaluate the strategies and their associated impacts on farming practices and livelihoods, particularly in the parts of South Kivu province. Our target was to obtain critical information to help develop and modify policies and guidelines to improve access to land in highly populated rural farming regions of DRC.

Theoretical background

Numerous studies document insecure and poor access to land as a characteristic defined by small farm size (few and small farm plots; Bashangwa Mpozi et al., 2020; Ndip et al., 2023). Limited land access was associated with smaller pieces of farmland that do not meet farm production needs as well as a lack of sufficient land for agricultural production (Van Acker, 2005; Jin and Jayne, 2013; Bashangwa Mpozi et al., 2020; Ndip et al., 2023). High dependence on farms for food and household income and limited non-land/farm alternative sources of livelihood are among the characteristics of poor small-scale farmers (Bashangwa Mpozi et al., 2020). Most resource-poor farmers face limited access to agricultural land or face land access challenges (Bashangwa Mpozi et al., 2020; Shamamba et al., 2021).

Poor land access for agricultural use among rural small-scale farmers is a growing crisis in sub-Saharan Africa and has been linked to poverty and food insecurity (Alinovi et al., 2008; World Bank Group, 2018; Angélique et al., 2022). Poor land access prevents mechanisation and adopting of sustainable agricultural practices (Bucekuderhwa and Mapatano, 2013; Hailu et al. 2014; Cituli et al., 2020). The crisis is complex, involving cultural, social, and economic aspects at both household and communal levels, and it is also directly impacted by local and regional political environment and economy. Therefore, addressing the land access challenge requires Multifaceted approaches.

Common land access modes described in the literature include inheritance, leasing, and land purchase (Jin and Jayne, 2013; Headey and Jayne, 2014; Abay et al., 2021). Land leasing and purchasing are vital for coping with limited access to agricultural land (Headey and Jayne, 2014; Abay et al., 2021). These two modes of land access have also been described as indicators of a need for additional land for agricultural and other uses (Muraoka et al., 2018; Bashangwa Mpozi et al., 2020). In agricultural production, these two modes of land access depend on household income, access to extra income, and the ability to obtain financial gains from farm and non-farm ventures (Bashangwa Mpozi et al., 2020).

Some initiatives support implementing policies and rules on land markets, mainly including official documentation in land transactions; such interventions are policy and other regulatory-based systems that improve the security of land markets (Mushagalusa Mudinga and Nyenyezi, 2014). In southern China, the availability of official land ownership documents was critical and positively supported participation in the land rental market among farmers (Min et al., 2017). An example of documentation reforms in South Kivu was the issuing of customary land certificates in Walungu, initiated by the Social Action and Peasant Organization (ASOP), which granted the plot sheet and the customary certificate of land recognition in Kabare (issued by IFDP). These land titles brought together several beneficiaries and collective security (Baraka Akilimali et al., 2021) but did not concern the rental of land materials, which could be a fundamental land access mode for smallholder farmers.

Limited land access was generally a situation where land available was less than required, and this was predominant in small-scale farming practices (Headey and Jayne, 2014; Deininger et al., 2017; Bashangwa Mpozi et al., 2020; Abay et al., 2021). In this study, we characterise limited land access scenarios facing the smallholder farmers in the densely populated South Kivu province of DRC. We further describe the risks of limited land access in terms of vulnerabilities from household heads' education level and involvement in other activities to diversify income to support household livelihoods. We also analyse the relationship between these vulnerabilities and dependence on one of the three main land access modes: inheritance, leasing, and land purchase.

Materials and methods

Study area

This study covered the territories of Walungu and Kalehe, two of the eight regions in the South Kivu province of eastern DRC (Figure 1). Kalehe and Walungu are in the mountainous part of the South Kivu province, with high population densities (CAID, 2021; Makali et al., 2021). During the study period (December 2017 to February 2018), the population of South Kivu province was primarily agricultural (PNUD, 2009; CAID, 2021; INS, 2021).

The territories of Walungu and Kalehe are located in the west and north of Bukavu (the capital of the South Kivu province), respectively. They are mainly located in the mountainous part of South Kivu, whose altitude ranges from ~900 to 3,000 m above sea level, while the mean temperature varies from ~18 to ~20°C (Katunga et al., 2014; Shamamba et al., 2021). The soils in south Kivu comprises dystric Nitisols/Ferrosols and Humic Nitisols/Ferrosols characterised by high levels of acidity, phosphorus deficiency, and some level of aluminium toxicity, which negatively affects crop yields (van Engelen et al., 2006; Nabintu et al., 2020). In Walungu, as in Kalehe, agriculture is mainly characterised by food production (cassava, beans, corn, banana); industrial crops are grown primarily in Kalehe, and they include coffee, tea, cinchona, and oil palm (in the lower altitudes; Shamamba et al., 2021).

The selection of Walungu and Kalehe territories for the study was because these territories were densely populated (>200 inhabitants/km^2). Furthermore, these territories faced land access disparities from the large-scale land concentration by the elites who used it for large-scale agricultural and mining ventures to smallholder farming households practising agriculture for household food and livelihood needs. Therefore, these territories allowed us to capture the unique land access, use, and associated challenges in the South Kivu province of DRC.

Field surveys and data collection

Sample size estimation

The study site comprised the territories of Kalehe and Walungu; these regions had an estimated 20,000 smallholder farming households based on data from the South Kivu Provincial Agriculture Inspectorate. The estimation of the minimum sample size for inclusion in the study was based on Yamane (1970) formula (Yamane 1970), as described by Bashangwa Mpozi et al. (2020).

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the total target population, and e is the level of precision with N = 20,000 and e = 10%.

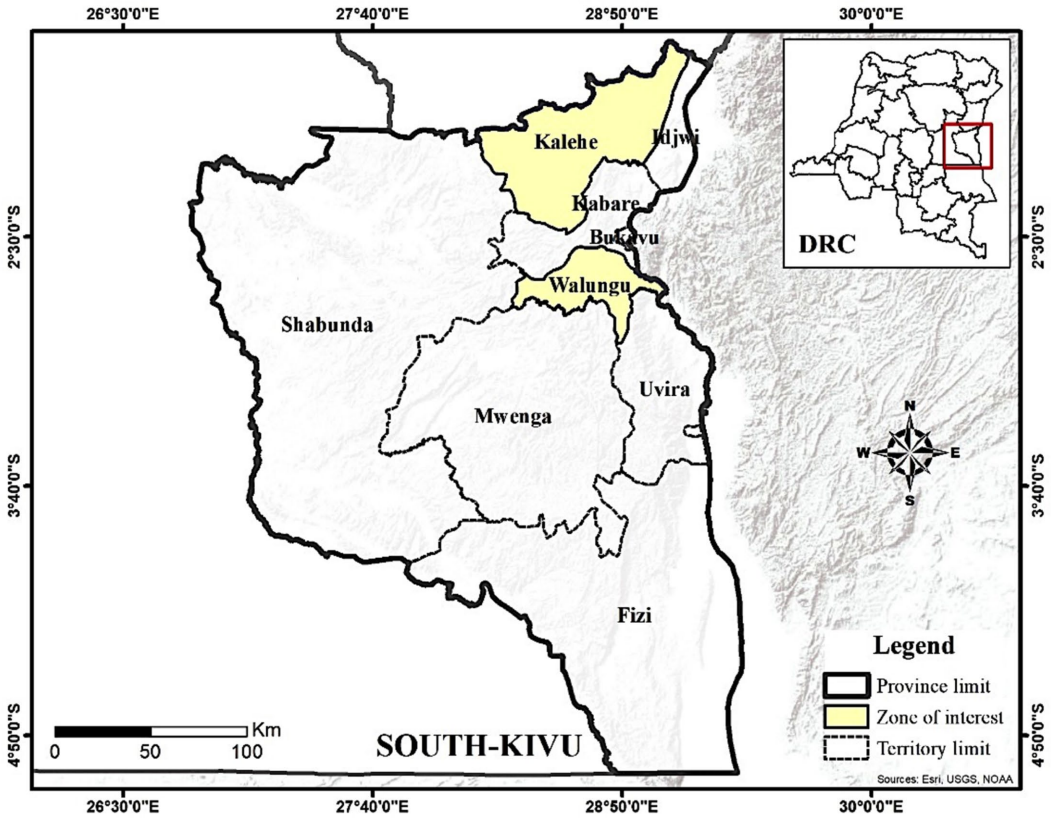

FIGURE 1
The administrative map of the study area with Kalehe and Walungu territories of the South Kivu province of the Eastern part of DRC.

From the calculation, our study required a minimum of 100 smallholder farming households. We initially targeted to reach a population of about 150 smallholder farming households; however, during the field excursion and the pilot study, more farmers consented to participate in the study. Therefore, per the project budget limits, a sample of 240 smallholder farming households was randomly selected for inclusion in the study.

To ensure the validity and reliability of the data collected, we worked with 20 key informants, comprising agricultural service officers and index farmers (as identified by Agricultural officers and local authorities) in Walung and Kalehe territories. We consulted the local customary leadership and land registry offices to help identify the smallholder farmers who were actively involved in agricultural practices and had limited land. The informants were also crucial in identifying the plantation farmers engaged in providing land for leasing and sharecropping by the smallholder farmers. The field survey involved an on-site visit to the farming household and a visual inspection of plots and existing plants, and these prevented some of the bias from self-reporting.

Sampling and data collection

Study households were randomly selected following a next drawing, without replacement on the households' lists, within the villages of Lurhala and Ikoma (Walungu territory) and Mbinga south (Kelehe territory) from December 2017 to February 2018. We selected these villages because they had good security and were accessible. Furthermore, these villages had high population densities due to high land pressure linked to the high concentration of the population. The majority of the population of these villages were smallholder farmers. Mbinga South Village was uniquely important because it had large plantations and large-scale farms owned by the elites as well as a higher concentration of smallholder farmers (Claessenspar, 2013; Cirimwami et al., 2019), creating the opportunity to study the co-existence and relation among them and the impact on the land access situation among the smallholder farmers.

The farmers consented to participate in the study at the beginning of the data collection. We conducted on-site farm visits, field/farm inspections, and interviews with the farming households. The data collection also included semi-structured questionnaires to obtain information on households' characteristics and details on land availability, including the number and size of farm plots, the mode of land access, farming practices, and constraints related to land access. Additional data from seven large-scale landowners from Mbiga south village (Kalehe territory) with information on their involvement and views on land markets, especially the land leasing practices, was also gathered. Additionally, there were interviews with other stakeholders from the land registry, customary authority, and development organisations working with small-scale farmers in the territories of Kalehe and Walungu.

Data analysis

We organised the data collected in Excel data files and subjected the data to descriptive statistics. The analyses involved the

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estimation of frequencies, the mean as a measure of central tendency, and supplemented by the measure of dispersion, mainly the standard deviations. We then generated tables to represent the results.

The data did not meet the normality distribution requirements for us to undertake multiple regression analysis (MLR); however, to understand the dynamics of land access modes among the surveyed household, we undertook a Pearson correlation analysis considering the reported variables. In this analysis, we considered the reported socioeconomic characteristics of the households as critical, independent variables that impacted the land access situation, land use, and the strategies employed by the household to handle challenges of land access and use. These independent variables included the household size, sources of income of the household, age of the household head, level of education of the household head, and alternative source of income/formal employment of the household head. We then considered the farm-based resource-depended variables comprising the average farm plot size, the number of plots obtained by different modes of land acquisition among the three significant modes (inheritance, purchase, and renting), the number of farm plots, size of land owned by the households, type of crops grown by the households (food and cash crops), and the type of farm practices employed (i.e., mixed farming versus monocropping). We then organised direct and implicit responses to the open-ended questions into categories of descriptions of the land access situations among the smallholder farming households of the South Kivu province of DRC.

Results

Demography and other characteristics of the surveyed households

Among the surveyed households, 120 were from Lurhala and Ikoma (Walungu territory), and 120 were from Mbinga South (Kalehe territory). Most household heads (85%) were male. The age of the household heads ranged from 21 to 30 (17.65%), 31–40 (22.27%), 41–50 (20.17%), 51–60 (19.75%), and there were also those with >60 years (20.17%). These household heads also reported more than 30 years of experience in farming activities (Table 1). In terms of the education characteristic of the household heads, a substantial number had not attained formal education (33%), and the majority had attained primary education (37.5%). There were also reports of higher levels of education, with about 27% gaining secondary education and 2.5% attending college (Table 1). Household sizes among the surveyed farming households were an average of seven members (Table 1).

Households' access to land

The 240 surveyed households used a total of 698 plots. Surveyed farmers obtained many of these plots through purchase (40%) and inheritance (42%). On the other hand, these farmers acquired a few plots (18%) through leasing (Table 2). On average, the surveyed households used three farm plots, of which one was rented (Table 2).

TABLE 1 General characteristics of the surveyed households.

Characteristics	Description	Results
Gender of household head	Male	85%
	Female	15%
Household size (Mean ± S.D)		7 ± 3
Age groups of the heads of the household	≤20	0%
	21–30	17.65%
	31–40	22.27%
	41–50	20.17%
	51–60	19.75%
	>61	20.17%
The education level of household heads	None	33%
	Primary/Elementary	37.5%
	Secondary/High school	27%
	University/College	2.5%
The primary source of income	Agriculture	83%
	Small business	9%
	Salaried employment/ Wages	4%
	Other sources	4%
Farming experience (years; Mean ± S.D)		31.2 ± 17

Source: survey data.

TABLE 2 Characteristics of farming plots among surveyed households.

Household farm characteristics		Number of farm plots
Current average number (2017) of plots per household		2.9 ± 1.3
The average number of plots per household 10 years earlier (2007)		2.9 ± 2.4
Land share per access mode by area (current; 2017)		Area
Land access mode	Purchase plots (n = 279: 40%)	Area: 3,093 ± 2,813.5 m^2
	Inheritance plots (n = 292: 42%)	Area: 4,251 ± 3,392 m^2
	Rental plots (n = 127: 18%)	Area: 1,736 ± 747 m^2

Source: survey data.

The average number of plots accessed by the surveyed farmers had not changed over 10 years (Table 2). The average size of the farm plots used by these farming households was very small (<0.5 ha) across the three primary modes of land access recorded (land inheritance, land purchase and land leasing; Table 2). However, the inherited plots were relatively large (4,251 ± 3,392 m^2) compared to the purchase and leased plots. The purchased farm plots averaged 3,093 ± 2,813.5 m^2, while leased plots were much smaller, with an average of 1,736 ± 747 m^2 (Table 2).

Social and economic factors in land access strategies among surveyed smallholder farming households in the Eastern parts of DRC

In our results, the interquartile range of total farm size among the farmers in the study was 0.54 ha. Therefore, we considered four equal quartile categories of the land ownership characteristics (0 ≤ 0.5 ha, >0.5–1 ha, >1–1.5 and >1.5 ha) among the surveyed farmers to further understand the predominant land access modes, the situation of the household sources of income, and the farming practices observed. Among the surveyed households, the majority (58%) accessed less than 0.5 ha of farmland, which exhibited an extreme challenge of limited land access. Households in this category depended on inheritance and leasing as the predominant modes of land access. Their primary source of income was agricultural practices and involvement in small businesses. On their farms, they mainly grew food crops (cassava, maize, bean, soybean, peanut, and sorghum) and had barnyards (kept chickens, rabbits, and guinea pigs; Table 3). A moderate number of the surveyed households (22%) accessed >0.5–1 ha of farmland. This group had a high challenge of limited land access. Although with a slightly better land access scenario than group one, this group was very similar to group one, sharing the predominant land access modes (inheritance and leasing) and with similar sources of income and crops (Table 3).

Group three comprised a small number of farming households (14%) with access to >1–1.5 ha of farmland. This group had inheritance and land purchase as the predominant land access modes. Apart from agriculture, the group also had income from formal employment. Apart from food crops, this group also grew coffee and kept goats in addition to the barnyards (Table 3). Group four comprised a minimal number of farming households (6%) with access to >1.5 ha of farmland. This group had inheritance as the predominant land access mode. The group's primary source of income was agriculture. Apart from food crops, this group also grew coffee and practised agroforestry; they also kept goats and cattle in addition to the barnyards (Table 3).

We considered the reported land access modes and various socioeconomic variables in correlation analysis. There was a positive correlation between years of formal education among the household heads and increasing levels of their sources of income (from lowest to highest level of income; $r = 0.58$, p-value < 0.05). The increase in the source of income was also positively correlated with the average farm plot size ($r = 0.19$, p-value < 0.01). There was a positive correlation between the age of the household heads and the number of purchased farm plots ($r = 0.14$, p-value < 0.05). The results also indicated a positive correlation between the total number of farm plots and the average farm plot area ($r = 0.29$, p-value < 0.001). The number of inherited farm plots positively correlated with the total number of plots ($r = 0.35$, p-value < 0.001). There was a negative correlation between the age of the household and their income ($r = -0.17$, p-value < 0.05). The number of farm plots purchased positively correlated with the household size ($r = 0.19$, p-value < 0.01). The number of purchased farm plots positively correlated with the total number of plots ($r = 0.35$, p-value 0.001; Table 4).

Regarding leasing farm plots, the total number of leased plots negatively correlated with the age of household heads ($r = -0.14$, p-value < 0.05). The total number of leased plots was also negatively associated with the increase in income of the household heads ($r = -0.17$, p-value < 0.05). There was a positive correlation of the total number of leased plots with the total number of plots ($r = 0.35$, p-value < 0.001). The total number of inherited plots was also positively correlated with the total number of inherited plots ($r = 0.24$, p-value < 0.001; Table 4).

Land leasing as a strategy to cope with land scarcity

Land leasing practices had increased, especially in the Kalehe territory (Table 5). In this territory, 47.5% of the surveyed households used at least one leased plot (Table 5). It was a common practice for the smallholder farmers facing land access challenges and poor soil fertility of their current farming plots to rent out land from the neighbouring plantations. As such, among the seven large-scale landowners, each had an average of 133 sharecroppers using their land in 2017. These seven plantations totalled 829 ha (an average of 118 ± 98 ha per large-scale landowner), exhibiting the disparity of land access between the large-scale landowners and the smallholder farmers. To put it in perspective, the 120 surveyed smallholder households in the Kalehe territory shared only 84 ha (an average of 0.36 ± 0.7 ha per small-scale farming household). Thus, the seven plantations/large-scale landowners represented land shared among 768 smallholder farming households.

TABLE 3 Access to land and some other socioeconomic characteristics of households.

Land availability/ Total land owned	The proportion of households (%)	Average household size	Predominant land access/ acquisition mode	The primary source of household income	Main crops grown	Other farming practices by households
<0.5 ha	58	6	Inheritance and rental	Agriculture and small business	Food crops	Barnyard
0.5–1 ha	22	7	Inheritance and rental	Agriculture and Small business	Food crops	Barnyard
1–1.5 ha	14	8	Inheritance and purchase	Agriculture and employment	Food crops and coffee	Barnyard and goats
>1.5 ha	6	7	Inheritance, purchase	Agriculture	Food crops, coffee, and eucalyptus (agroforestry)	Barnyard, goats, and cattle

Source: survey data. Major food crops included cassava, maise, beans, soybeans, peanuts, and sorghum, while the barnyards comprised chickens, rabbits, and guinea pigs.

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TABLE 4 Correlation of farm access variables among the surveyed farmers.

	Age	Source of income	Years of formal education	Household size	Farming experience	Number of plots	Average farm plot area	Number of purchased plots	Number of inherited plots	Number of rented plots
Age	1.0000									
Source of income	−0.208***	1.0000								
Years of formal education	−0.3476***	0.5794*	1.0000							
Household size	0.0459	−0.0845	−0.0171	1.0000						
Farming experience	0.5241***	−0.1619*	−0.1876*	0.1300*	1.0000					
Number of plots	0.0650	−0.1931**	0.0135	0.2292**	0.1257*	1.0000				
Average farm plot area	0.0647	−0.1955**	−0.0939	0.1287*	0.1192	0.2882***	1.0000			
Number of purchased plots	0.1425*	−0.0918	−0.0924	0.1875**	0.1674**	0.3457***	0.0877	1.0000		
Number of inherited plots	−0.0070	0.0364	0.0844	−0.0041	0.0167	0.1717**	0.1516*	−0.4484***	1.0000	
Number of rented plots	−0.1400*	−0.1657*	−0.0179	0.0960	−0.0834	0.3482***	0.0441	−0.0746	−0.2389***	1.0000

Pearson's correlation with correlation coefficients r and *p*-values.
*p-values ≤ 0.05.
**p-values ≤ 0.01.
***p-values ≤ 0.001.

As the demand for land grew over the years, landlords increased rental charges and changed the rental terms at their discretion due to the absence of regulations by public authorities. Responses from the surveyed farmers indicated that the rented plots generally had acceptable fertility (Table 6). These plots had fertility varying from medium to Excellent for 87% of sharecroppers (Table 6). Most of this leased land was in the valleys and less prone to soil fertility loss by erosion, which was prevalent in the hills. Rental obligations differed from one landowner to the other. Still, they had many similarities in things that land-renting households were to adhere to and were not allowed to do on the leased plots; these rules covered the rental period, the type of crops permitted in the rented plots, and the obligations for the sharecroppers as described below (Table 6).

Duration of the rental contract

The rental agreement was generally for 1 year and had to be renewed yearly (Table 6), and households had to cultivate one-year cycle crops. While this was not a problem for annual crops such as maize, beans, and peanuts cultivated more than once a year, the problem arose for cassava, which lasted longer in the field under the high-altitude conditions encountered in the cold mountainous South Kivu. Therefore, its production was discouraged due to a need for earlier harvest before the complete maturation of the crop; however, it is critical to note that cassava produce was considered an essential food diet in the East DRC region.

Prohibited crops

Perennial crops were formally banned on leased land (Table 6). The surveyed farmers could not plant crops such as coffee, cinchona, or agroforestry trees could not be planted on these plots. However, crops such as coffee are crucial and provide a stable income for households in the South Kivu province (Pole Institute, 2014). Crops considered exhausting for the soil, such as sunflowers, were prohibited in some plantations. Other important crops were also affected; in particular, the communities in the East DRC region cultivate bananas and plantains on residential plots and use these plants as indicators of a family residence zone. These key food crops were also not allowed on leased land.

Obligations for sharecroppers

In surveyed plantations, households leasing land were subject to an average annual payment of 60 USD per farm plot. However, these payments ranged between 40 USD and 75 USD per farm plot in Kalehe (Table 6). In Walungu, households paid much less (i.e., a goat or its local value between 50 USD and 70 USD for 3 years, and sometimes 10 USD per season). The progressive soil fertility depletion resulted in farmers' demotivation and justified the lower rental price in Walungu (Table 6). In addition to the rental payment, households had to provide 1 or 2 days of work (Salongo) at the plantation monthly. The lessee provided labour to maintain internal roads on the farm and worked on other tasks as per the needs, sometimes involving labour for the crops and fodder production for the landowners.

The landowners use the fertility of the leased land and the local demand for land in setting lease contract obligations (price, number of working days). However, the need for land was reported to be consistently high, particularly in Kalehe. We also noted that, in some cases, the labour from lessees, "salongo," was required from sharecroppers; however, this practice was highly

TABLE 5 Development of leasing/sharecropping among the surveyed households in Kalehe territory from 2013 to 2017.

Plantations	Size (Ha)	Year					
		2013	2014	2015	2016	2017	Minimum land rented out to households in 2017 (%)*
Ihusi	82	35	50	80	120	120	36.6
Katashola 1	130		90	120	140	113	21.7
Katashola 2	50	30	45	70	95	115	57.5
Luzira	70			87	112	185	66.1
Nyambasha	54				45	120	55.6
Buloho	93					60	16.1
Kabira	350					150	10.7

Source: survey data. Considering the farmers concerned could rent at least one 0.25 ha field on the plantations in question. (Land leasing data was missing for some years in the plantations.).
*Percentages based on the 0.25 ha made available to farmers in 2017,

TABLE 6 Characteristics of leasehold system among the surveyed households in Kalehe and Walungu territories.

Reported characteristics of leasehold terms	
The average number of rented plots	0.5 ± 0.8
The average cost of a leased plot	59.85 ± 45.63 USD pa
The average size of leased plots	1,736 ± 747 m^2
Soil fertility reports (%)	Excellent (8%)
	Good (40%)
	Medium (39%)
	Poor (13%)
Payments	Cash (160–300 USD per ha/pa) and in nature (2–4 goats), depending on the landowner's requirements
Other lessee obligations	Some days of work on the landowner's farm (52 person-days per year)
Reported significant constraints faced by leases	i. Restrictions in terms of perennial crops (100%) ii. Short rental period (100%) iii. Precarious contract (100%)
Reported advantages of leasehold terms	i. Availability of land with generally acceptable fertility (87%) ii. A valuable alternative for landless households (100%).
Reported disadvantages of leasehold terms	i. Alienation by landowners (43%) ii. Limitation to cultivating some profitable crops (86%)

Source: survey data. Soil fertility assessment was based on the capacity of a field to produce the common crops of the region, cassava, maise, and beans, among others, as perceived by its owner (as reported by household heads). Thus, fertility was excellent where yields were high and poor on land where yields were too low.

variable, and the economic cost to the sharecroppers was largely undetermined. Some plantations did not charge anything but aimed at obtaining the labour force from the sharecroppers for their perennial crops, mainly coffee. Under these conditions, sharecroppers' food crops were planted between rows of coffee, allowing the coffee plants to benefit from weed control. In these kinds of plantations, plants deemed too exhausting for the soil, such as cassava, were prohibited. The landowners preferred the lessees to grow plants that could enrich the soil, such as legumes (soybeans, beans, and peanuts), for the benefit of the coffee.

Discussion

Household demography, farm plots, and land access modes among smallholder farming households in the Eastern parts of DRC

Most households' heads (85%) were men, typical of the region's culture and customs, in which men were considered the household heads. The majority (63%) of these household heads were between 21 and 60 years old (Table 1). The age range of 21–60 represented energetic individuals who could be actively involved in agricultural activities. The household sizes were large (~7); such large households are typical in rural sub-Saharan African farming communities due to the high birth rate in such regions (Bashangwa Mpozi et al., 2020; Maja and Ayano, 2021). Other studies in Burundi, Ethiopia, Kenya, Malawi, Niger, Nigeria, Tanzania, and Uganda have also reported large household sizes (average of 5 to 7 family members; Deininger et al., 2017; Bashangwa Mpozi et al., 2020; Kijima and Tabetando, 2020). From the survey, the households reported to have used an average of three small-sized (≤ 0.5 ha) farm plots over 10 years (Table 2).

Furthermore, our results indicated that surveyed farmers practised mixed farming, mainly producing food crops (cassava, maize, common bean, soybean, peanut, and sorghum) and kept chickens, rabbits, and guinea pigs. Although a few also grew coffee. We believe that the consistently lower number of farm plots over several years, the practice of mixed farming, and the high focus on food crops may have indicated that these farmers' agricultural practices were mainly for household food. They also indicated the possibility of low income from the farm and difficulty for households to acquire new farm plots or difficulty in entry to the production of high-value crops and livestock. These scenarios may have prevented the full realisation of the farm labour advantage of the larger household sizes.

Considering the average age of the household heads among surveyed smallholder farming households (46 years) and their long experience in farming activities (31.2 years), these characteristics indicated extended exposure to farming activities as the primary form of livelihood; this meant a high dependency on the farm and also implied a likelihood of lack of other steady alternative sources of income to purchase more land. There were no significant changes in the number of farming plots over the 10 years. However, increased differences in the number of plots between households were evident from the increased deviations in the number of plots (Table 2). These changes may be due to the high practice of inheritance (42%), land purchase (40%) and land leasing (18%) among the smallholder farmers in the study. Furthermore, in Kenya and Uganda, young farmers with limited land have been found to consider leasing as an essential way of accessing more land for agricultural production (Kijima and Tabetando, 2020). In developed countries, this situation could not be very different; in the case of the southern part of China, there is evidence that older farmers lease land to younger farmers (Min et al., 2017).

The households in the survey exhibited a high household size (7 family members). In previous studies, rural smallholder farmers who relied heavily on land inheritance also contributed to land fragmentation (Bashangwa Mpozi et al., 2020; Abay et al., 2021). Other reports indicate that large families that were ordinary in highly populated regions have weakened traditional systems for land access since colonial times, promoting alternative forms of land access, mainly leasing and land purchase (Bashangwa Mpozi et al., 2020; Angélique et al., 2022). The high population growth in this study area (INS, 2019) increased the risk of widespread land fragmentation. In particular, the results of the study indicated small farm plot sizes (less than 0.5 ha) in the majority of the surveyed farming households (~80%; Table 3). We attribute these results to inheritance and the higher population growth that may have promoted the fragmentation of farm plots, leading to the small sizes. In 2000, De Failly noticed that the rural landscapes in South Kivu were like "small expanses checkerboards" in which small plots kept being divided (De Failly, 2000).

Furthermore, large households and small farm sizes owned by these farmers, especially under high dependence on inheritance, have a potential risk of land fragmentation (Bashangwa Mpozi et al., 2020). Farming households in our study exhibited three conditions: small farm size, large household size, and high instances of inheritance. Hence, there was an increased risk of extensive land fragmentation from the inheritance practices.

The large household sizes in our study could have indicated high population growth. Increased population increase food production needs to meet the new demands, and this could exert a lot of pressure on farms and subsequently promote leasing and land purchase for agricultural ventures (Binswanger-Mkhize and Savastano, 2017; Bashangwa Mpozi et al., 2020). Concerning land purchase, our study results show that farmers who had the financial means and resources to purchase land were rarely involved in land leasing (Table 3). These results indicated that in some situations, alternative sources of income could be vital in improving land access. However, multiple factors caused the land access challenges in the study area: high population density (Jayne et al., 2014; INS, 2019, 2021; Makali et al., 2021), land access disparity (Alden Wily, 2012; Geenen and Hönke, 2014), and challenges due to war and conflicts (Musahara and Huggins, 2004; Maass et al., 2012; Geenen and Hönke, 2014), several different strategies could help improve the situation.

Characteristics of land access farming and other economic ventures among smallholder farming households in the Eastern parts of DRC

In socioeconomic terms, land access by smallholder farmers in Eastern DRC was deficient among the surveyed farmers. Our results showed that 80% of the surveyed households used less than 1 ha of land (Table 3). These observations are consistent with the reports on land access characteristics among smallholder farmers in sub-Saharan Africa, where about 90% of smallholder farmers access and use less than 5 ha for agricultural production (Jayne et al., 2016).

Our study found a positive correlation between the critical household socioeconomic characteristics comprising household head level or education, household head age, and additional non-farm sources of income (non-farm employment) with land purchase (Table 4). However, we note that the household head age was negatively associated with land leasing and alternative income from alternative non-farm sources. Since the majority of farmers had small farm plot sizes, we report that the limited access to land to most young farming households in the study supported their involvement in other economic activities (ventures such as small businesses) to supplement their household needs; however, these ventures could not earn sufficient income to support land purchase (Table 3 and Table 4). There was an impact on crop diversification; due to short and restrictive land lease contracts, most surveyed farmers had to stick to food crops with limited ventures in high-value crops for commercial markets, such as coffee and afforestation (especially eucalyptus-based). Furthermore, some farmers reported an inability to venture into mixed farming, especially in cattle rearing. As such, they missed out on the possibility of improving the soil fertility of their farms using manure from cattle.

Our results showed that young household heads were more likely to lease than to purchase land (Table 4). In the events of limited access, alternative land acquisition strategies comprising land leasing and purchasing land kick in (Lambin and Meyfroidt, 2011; Headey and Jayne, 2014; Abay et al., 2021). Other studies describe land leasing practices as important to young small-scale farmers (Min et al., 2017; Abay et al., 2021), especially in China (Min et al., 2017), Kenya and Uganda (Kijima and Tabetando, 2020). Land leasing positively impacts land productivity (Jin and Jayne, 2013), especially in commercial production ventures (Kijima and Tabetando, 2020; Acampora et al., 2022). These results have significant implications, given that we also observed several restrictive leasehold contracts indicating that these young farming households leasing land may not be able to exploit leased plots fully, hence benefiting less from the practice. In other studies, the land rental markets in sub-Saharan Africa have also lacked sufficient regulatory measures and exhibit non-standard rental contracts and highly variable rental terms among leases (Mugangu, 2008; Bashangwa Mpozi et al., 2020).

The growth in the number of sharecroppers per plantation reflected that the need for land was increasing and that the majority

(80%) of households who accessed < 0.5 ha of farm plots had no choice but to seek land from large-scale landowners (Table 5). Thus, the number of sharecroppers increased by 139% between 2014 and 2017, going from 33 to 118 households, considering the plantations that had data over the entire period under review (Table 5). Groups one and two of the surveyed farming households faced a preeminent challenge of land access (Table 3); among these two groups, land inheritance and leasing were the predominant forms of land access, given that inheritance is less reliable under high population pressure. In southern China, the land leasing market among smallholder farmers has a different scenario, in which older farmers lease land to young farmers (Min et al., 2017).

Through self-reporting, most of the leased land had acceptable soil fertility. The households in the study reported medium (42%), good soil fertility (38%), and excellent (6%) soil fertility of their rented plots based on the crop yield obtained in these plots (Table 6). However, we note that the territories of Walungu and Kalehe are in the mountainous part of South Kivu province, where soil erosion is widespread. Therefore, the high soil fertility is likely only stable in the lowlands and may be a temporal situation. The study region could be prone to erosion, requiring soil erosion and soil fertility management practices to be implemented by both the landowners and the lessees. However, long-term investment in soil fertility management could not be easy to implement, given the temporal nature of leasehold contracts. A previous study on adopting passion fruit production among smallholder farmers in East Africa reported that land leasing terms offered less motivation for investing in soil fertility management practices by leasing farmers, especially in practices such as soil erosion management due to the short-term nature and lack of security of these leaseholds (Bashangwa Mpozi et al., 2020).

Furthermore, Kenyan farmers renting land practised less use of organic fertiliser in the rented plots versus their owned non-rented plots. The temporal land rental contracts (annual and seasonal) could prevent the use of organic fertiliser in the rented plots. These short contracts hindered long-term investment in the rented land due to fear of contract termination before attaining the benefits of such an investment (Muraoka et al., 2018). However, it is imperative to note that should the scenario differ for land leasing smallholder farmers in Eastern DRC, the investment cost in soil erosion management practices could be expensive and likely unfordable since these are resource-poor farmers (Heri-Kazi and Bielders, 2020). There are needs for, strategies to incentivise and encourage smallholder farmers leasing land in Eastern DRC to invest in fertility management and measures for reducing soil erosion to prevent a loss of soil fertility in the rental land markets over time.

Constraints to land access through leasing among the smallholder farmers in the South Kivu part of Eastern DRC

The short characteristics of the most leasehold terms among the surveyed farmers (~1 year) presented a limit to the production of crucial food required in the diet among the surveyed farming households; for example, cassava, a significant diet crop in Eastern DRC, required >1 year to mature because of the cold conditions in this region. As such, the one-year contract prevented the cultivation of this crop. This short leasehold contract period could have limited the investment in good cultural practices such as soil fertilisation and erosion control since short leasing contracts were associated with less investment in soil fertility management practices by the lessees' (Mugangu, 2008; Bashangwa Mpozi et al., 2020). The short lease also impacted the choice of farm inputs; for example, in Kenya, the use of chemical fertiliser was higher in rented farmland versus more organic fertiliser in owned farmland (Muraoka et al., 2018).

Our results indicated crop restrictions and prohibitions in the leasehold contracts. Restrictive leasehold contracts were a significant disadvantage to farmers leasing land, especially since some prohibited crops were crucial for the households' diets and economic well-being, especially for bananas and coffee. Finally, the high land prices, high land rental fees, and lack of regulation of the land leasing markets exposed the surveyed framers to high exploitation by the large-scale landowners, especially in cases where the lease conditions required lessees to offer unregulated labour services in the plantation farms. Poorly regulated land lease contracts have been documented to run the risk of becoming exploitative (Deininger et al., 2017; Paloma et al., 2020). Therefore, improved benefits of land markets among smallholder farming households could require standard policies and regulations.

Conclusion

In addressing the challenge of limited land access for agricultural production by smallholder farmers in Eastern DRC, these farmers are shifting from reliance on traditional customary land access means to land purchase and rental markets, where they face varying challenges, from high land prices to poorly regulated rental markers. The rental markets appear an easy target to many of these resource-poor farmers. However, there were still high rental costs and restrictive use terms. Our results indicate that these farmers are also motivated to rent land because of the high soil fertility; however, we note that the highly restrictive nature of the rental contracts may impede investment in good farming practices that maintain the high soil fertility, and this has the potential of degradation of soil fertility of rented land.

In regions experiencing high population growth and with land access disparities, such as in the Eastern part of DCR, there is a likelihood of increased reliance on land leasing for agricultural production; therefore, we recommend setting up public authorities to regulate land rental markets. We acknowledge the ongoing DRC land reforms, aiming at ensuring easy access to land by the different population categories, and suggest the inclusion of regulations on pricing and leasing fees, especially in the rural areas, to prevent exploitation of small-scale farmers and reforms that encourage rental price controls, long-term lease contracts, and reduced leasehold restrictions. Incentivising farmers through financial support at low-interest rates and longer lease terms may enable renting land for use in commercial crop production, which may increase the income of these smallholder farmers. Studies on other socioeconomic factors that impact household investment in farming and impact on land access could also generate valuable information in addressing challenges associated with limited land access.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

DS: Conceptualization, Formal analysis, Investigation, Project administration, Writing – original draft, Writing – review & editing. BM: Formal analysis, Writing – original draft, Writing – review & editing. AE: Writing – original draft, Writing – review & editing. EB: Conceptualization, Formal analysis, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2023.1277031/full#supplementary-material

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