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Effects of changes in traditional land tenure administration on land use/cover dynamics in rural Zambia.

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ABSTRACT

Goal and Objectives:

This paper examined the relations between informal documentations and land tenure security on change in land use/cover. Using Chamuka land registration, the paper focuses on caused of land use /cover change and how informal documents-based land dealings leads to tenure security and a more productive land use.

Methodology:

The study used various methods, including 345 households' interviews, group discussions and satellite images of 2010, 2015 and 2020, to understand how land ownership in Chamuka chiefdom effect on land use.

Results:

The study results shows that the introduction of Land Advisory Boards (LABs), Customary Certificate of Land Occupancy (CCLO) and the land register has scored several successes (i.e., increase in land rights, ownership, low cost of land registration, tenure security and reduction in land-related conflicts. Other improvements include the practice of conservation farming, i.e. agroforestry, fire management resulting to improved crop and livestock farming. Despite these positive results, the satellite images showed decline in vegetation and forest cover due to expansion of agricultural area, buildup and decrease in water bodies. This study provides new insights into how the evolution of the traditional land tenure system, as an integral part of resource governance, its effect on land use/cover. Next to suggesting is how to strengthen informal documents, and efficiency of local land management institutions in order to reduce loss of vegetation and deforestation.

Keywords:

Informal certification, Mapping, opportunities, Village Land Advisory Boards,

1. Introduction

In Sub-Saharan Africa (SSA), communities under customary land tenure systems collectively hold and manage resources, such as land, forests, and water bodies (Mudenda, 2006). Furthermore, households belonging to these communities depend on land as their source of food, income and livelihood (Peters, 2013). In addition, under the traditional land tenure system, resource sharing is on individual needs and norms as guidelines (Honig, 2014). However, recent studies such as Cotulla and Delville, 2007, Neves, 2007 Umar & Nyanga, 2022) have observed the transformation of communal property tenure rights from individualism to private ownership under customary systems. This change in land administration and property rights under customary tenure systems (access, ownership and disposal) has been attributed to high demand for land, mainly for agriculture and other land uses such as mining and housing (Deville 2007; Yngstrom 2002). Other studies, such as Norberg and Milja (2018) and Munshifwa et al. (2020), have also highlighted high adoption among traditional institutions of new systems of resource governance involving the introduction of stiffer regulations such as record keeping in their chiefdoms, which were absent in the past. The introduction of local record keeping, and individual informal documents under customary tenure as a new method of managing resources, increasing tenure security and restricting communities from neighbouring chiefdoms to the practice (Feder and Feeny, 1991; Kalabamu, 2000; Cotula and Neves, 2007; Delville, 2007).

Even though such changes in customary land administration reflect in most customary systems, including Zambia and several African countries (Janvry & Sadoulet, 2003; German et al., 2011; Nyairo, 2011; Hull et al., 2019). The link between state titles and sustainable land management has featured prominently in most early agriculture economics, but informal documents and sustainable land management are separate in most areas of research (Hichaambwe et al., 2014; Chitonge et al., 2017 Asiama & Arko-Adjei, 2022). Recent studies have also seen many publications on the informal documents and sustainable land administration conceptually described rather than operationally proven (Boone, 2019; Huntington & Shenoy, 2020; Umar & Nyanga, 2022). It is unclear whether such evolution in tenure rights has contributed substantially to the recovery of land cover/use under customary tenure. Changes in land administration can also affect land use and cover (Alemayehu et al., 2009). Modelling land use and cover changes are essential as they assist in planning, developing awareness, and restoring the environment, and policy change and programs in resource management (Daba and You, 2022). This study focuses on changes in traditional land tenure systems and their impacts on land use/cover changes. Firstly, this study examines if the dynamics perceived in resource management through land use and land cover changes (i.e., spatial extent and degree) are associated with a change in customary land tenure rights. We examined the implications of such changes at the institutional level regarding resource governance. This study seeks to answer the effects of a change in traditional land administration on land cover change and use.

2. Materials and methods

2.1 Study site

We conducted this study in Chamuka chiefdom under Senior Chief Liteta of Chisamba District in the Central Province of Zambia (Mushinge et al., 2020). The chiefdom is between two rapidly growing urban areas, Kabwe in the north and Lusaka in the south. Chisamba District covers 2, 978.5 km^2 and

is located between latitudes 14° 30' and 15° 00' S and longitudes 28°00' and 28° 30' E at an elevation of 1, 138 m above sea level (Saasa, 2003). The temperature ranges from 14.31 to 27.31°C. The district is in the Agro-ecological Zone II a (AEZ II a), with an annual rainfall of 800 and 1,000 mm. The community experiences three climatic seasons that are based on precipitation and temperature: hot and dry (September – November), cold and dry (April – August), and warm and wet (December – March). Figure 1 shows the location of Chamuka chiefdom in Zambia.

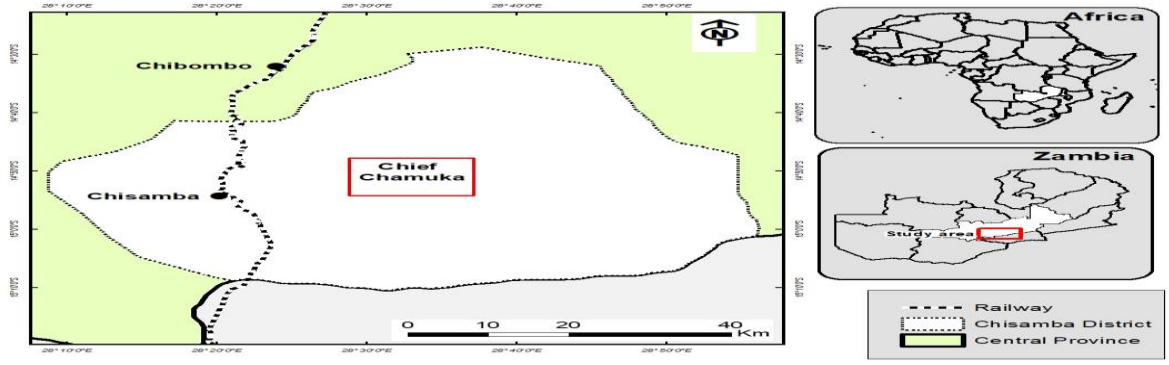

Figure 1: Location of the study area – Chamuka Chiefdom in Chisamba District of Central Province of Zambia.

2.1.1 Site and sample selection

The study site recently introduced Village Land Boards to its traditional structures. The chosen area, Chamuka Chiefdom, represents the main rural village types of the Chisamba District of central Zambia (Central Statistical Office, 2019). In addition, due to the introduction of individual informal documentation, that has been taking place (Mushinge et al., 2020), Chamuka Chiefdom and Chisamba District were chosen as ideal cases that would provide data on the customary land rights[1].

This study area is 30 km from the urban centres of Kabwe and Lusaka. Chamuka consists of 207 villages covering a spatial extent of approximately of about 33,000 hectares (Katungula et al., 2020). From 207 villages' 11 villages covering 538 hectares with a total population of 3,102 enumerated using the Social Tenure Domain Model in 2016 under a donor project[2] (Katungula, et al., 2020). About 491 households from 11 villages out of 207 had informal individual land certificates.[3]Thus, the village list and information from the Central Statistical Census (2019) was a sampling frame, and they randomly sampled 345 households using the formula to determine sample size with a confidence level of 95%.

In each village, the record from the register list assisted in selecting respondents with informal certificate landholders. Furthermore, the selected households to participate in the interviews included consultations with local experts (e.g. government officers, Non-governmental organization staff, and private sector actors like businesspersons) and community members in the area (Gaziano, 2005). In each village, purposive sampling was used to select participants (i.e., households), especially those who have lived in the chiefdom as early as 2005 or longer than that period. It was

[1] Social Tenure Domain Model
[2] People Process on Housing and Poverty in Zambia (PPHPZ), Zambia Homeless and Poor People's Federation (ZHPP), Global Land Tools Network (GLNT) of the UN-HABITAT
[3] Customary Certificates of Land Occupancy

important to consider community members who have lived much longer in this chiefdom because they understand the history of this area's traditional land tenure system. Furthermore, the respondent's interviews included households issuing land documents, with priority given to those who participated in the mapping exercise of individual plots. Only land parcels mapped and enumerated using the Social Tenure Domain Model (STDM) were included in the study to capture change in forest cover.

2.1.2 Socio-economic survey

Household interviews focused on the socio-economic issues of traditional resource management, such as agriculture expansion and income generation, challenges in triangulation of agriculture seasonality, and non-agriculture workloads. The household interviews also sought information on land use activities in the area before and after informal individual land certification. Furthermore, interviews identify the leading causes of vegetation loss in the area. Other questions focused on finding out the performance of casual personal land certification in resource management and reasons for continuing with land documents.

The study selected four focus group discussions (FGDs) in each village (Kasheta, Bunda Bunda, Chipempe and Nagoya) of the Chamuka chiefdom. Four groups of Focus Group Discussions (FGDs) had eight people and equal males and females. The FGDs included those who had lived in the chiefdom before 2014 and the introduction of CCLO. These respondents were essential to the study, as they had witnessed the various changes in land administration, vegetation and forest of the chiefdom. In addition, community members who had participated in the mapping and sketching individual plots were in the FGDs. Community members were essential to the study, as they have information on the importance of the discussion on the effects of the CCLO on land use.

Further, in each village, the researcher formed one group of key informants (K.I.) in each, six people, including chief retainers, village Head persons, and VLABs. The selected people were essential to the study as they had vast knowledge of the importance of CCLO and the community's various challenges to land use change. The K.I. included the village project implementing institutions such as chief and village headpersons chief were included in the study as they were part of those who issued informal certificates in the chiefdom (Anon., 1996). Further, the K.I. were relevant to the investigation as they set conditions of the CCLO and who was eligible to apply for land in the chiefdoms.

The FGDs and K.I. interviews focused on the livelihood aspects, land documents activities and current technological knowledge in mapping resources exercises using the Social Domain Model. Discussions also focused on the role of government and village leader's personnel in the implementation institutions in informing the community on the current technologies and practices in mapping and sketching plots and the importance of land documentation. During this study, community leaders provided information on community participation and resources provided by the project to support them in the mapping exercise.

2.1.3 Data analysis

The data obtained from the household interviews were coded and analysed by content analysis using Statistical Package for the Social Science (SPSS) version 25 (IBM, Endicott, New York). At the same time, the researchers summarised the discussion between FGDs and K.I. by identifying emerging

themes and categories several statistical approaches to analyse the socio-demographic and descriptive data of landholders. To study the effects of traditional land titling and to document changes associated with resource management, a frequent approach and Chi-square test of association. Further, the study calculated percentages and levels of significance on households' information like education attained by the household heads. The discussions also suggested drivers that influenced land pressures, loss of forest and vegetation cover in Chamuka, and participants to rank them in order of importance.

2.3 Land use and land cover change

To map the corresponding land cover changes in Chamuka chiefdom, we used Landsat images from the 2010, 2015 and 2020 time series. These time series represented significant shifts in the traditional land tenure system in the study area. This study used Landsat Thematic Mapper (TM) for 2010 and Landsat Operational Land Imager (OLI) for 2015 and 2020. Here, we focused on four broad land cover classes such as forest, agricultural area, water and built-up areas. These land cover categories specifically represented the shifts in the land tenure system on land use/cover. It showed details of land cover classes used in this study in Table 1.

Table 1 ; Details four land cover/ land use classes used in this study.

Land use/land cover	Description
Natural forest	Areas covered with trees forming closed canopy or nearly closed canopy.
Cropland	Cultivated land mixed with bushes, trees, and rural homesteads.
Built-up	Rural and urban settlements, including housing units, marketplaces and institutions.
Water bodies	Areas covered with rivers and streams**.**

2.3.1 Land cover classification using Google Earth Engine

We conducted processes leading to land cover classification in Google Earth Engine (GEE). The GEE is a cloud-based computing platform focusing on large-area land cover mapping (Mutanga & Kumar, 2019; Phan et al., 2020). The analysis of remotely sensed images on a web-based code editor without downloading these data to the local machine. In this way, users easily accessed, select and process large volumes of data for a large study area. Another critical aspect that makes GEE effective is the availability of several packages with many algorithms that simplify access to remote sensing tools for experts and non-experts (Phan et al., 2020).

We selected images for the dry season when most of the land covers were visible, and the photos were primarily free from the effect of cloud cover. We also applied cloud masking to those images with residual clouds.

We then generated 400 random points and separated them into training and validation samples using a ratio of 1:3. Thus, the study used 100 ima for validation, while they used 300 pieces for training. We then used the Random Forest machine learning classifier to produce land cover maps. This classifier is one of the most used algorithms in land cover classification because of three primary reasons: (1) good performance with high dimension dataset, (2) good handling of outliers and noise

data, and (3) higher classification accuracy than other popular classifiers, such as support vector machine (SVM), maximum-likelihood classification (MLC) and classification tree (C.T.). We set the Random Forest algorithm to 100 trees (ntree = 100), while the mtry is set to default, the square root of the total number of features.

We used the confusion matrix for accuracy assessment, which measures overall accuracy, user's accuracy, and producer's accuracy. Change statistics such as the magnitude of change and the rate of change showed changes in land use cover in the area. Equation 1 (Gilani et al. 2015; Puyravaud 2003) calculate the change in land cover

$$r = \left(\frac{1}{t2-t1}\right) \times \ln\left(\frac{A1}{A2}\right) \qquad \text{Equation (1)}$$

where r is the rate of change, t_1 and t_2 are the years at the start (1) and the end (2) of the assessment, and A_1 and A_2 are the areas at the beginning (1) and at the end (2) of the assessment period.

3. Results

3.1 Demographics, land documents and tenure rights

Table 1 shows the gender distribution of the heads of the households in Chief Chamuka's area. Of all the families interviewed, 51% were males and 49% were female. Nearly all the sampled households (100%, n=345) had one land title. There was no significant association between the head of household gender and possession of land title (X^2 = 2.4, df.1 = p = 0.116) and female (X^2 =5.7, df. = 1, p = 0.0117). The chi-square test also showed a non-relationship between a title and gender, except for those who had attended primary education.

Table 2: Demographic attributes of the respondents in Chief Chamuka, Central Zambia, in 2016.

Demographic Attribute	Household %	X^2	Degree of freedom	P-Value
Gender:				
Male	51	2.470	1	0.116
Female	49	5.662	1	0.012*
Marital status:				
Single	7	4. 6	1	0.32
Married	70	9.5	1	0.002***
Widowed	1	0.003	1	0.900
Divorced	16	0.8	1	0.312
Education:				
Never attended school	36	4,6	1	0.301
Primary	33.6	9.6	1	0.002***
Junior Secondary	27	0.001	1	1.000
Secondary education	2	0.93	1	0.600

*-statistically significant; ***-Very highly statistically significant

3.5 Land use/cover change detection

The study examined the land use/cover change by examining the 2010, 2015 and 2020 Chamuka chiefdom maps. Figure 3 shows land cover maps for 2010, 2015, and 2020, with accuracy ranging from 89% to 94%. The land cover maps for 2010 had the lowest levels of accuracy, perhaps because

of the low quality of Landsat TM compared to Landsat OLI. It is clear from the map that agricultural areas are expanding by opening forest areas. In addition, built-up areas have slowly been increasing over the years.

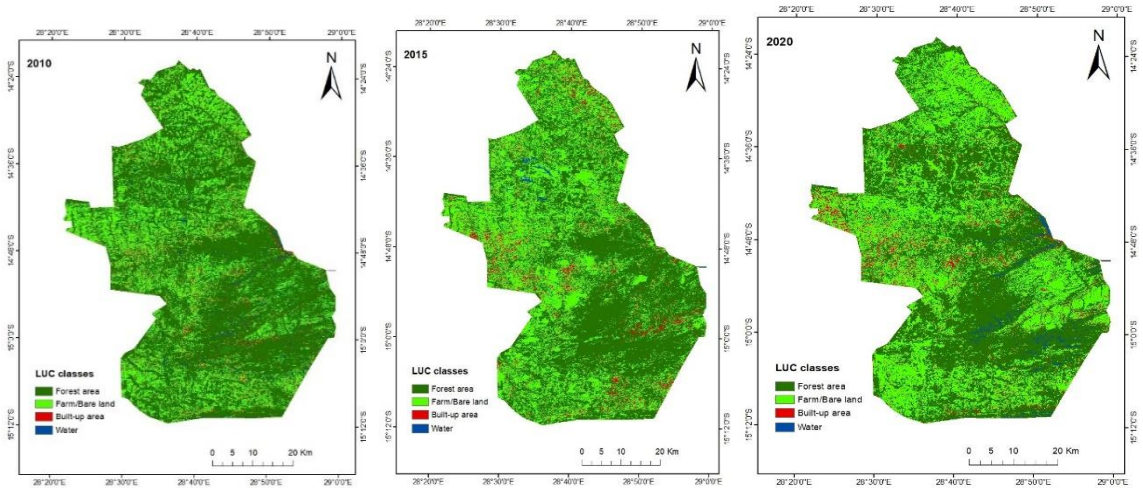

Figure 2: The percentage change in land use cover from the year to the next

Table 4 shows the land use/change changes for the four land cover/use classes between 2010 and 2020. Forest area decline was the highest between 2010 and 2015 at 9.18%. Forest area declined further between 2016 to2020. Similarly, agricultural areas increased by 11.13%, and the most significant agricultural expansion occurred between 2010 and 2015. Built-up regions followed a similar increasing trend, while water bodies declined.

Table 5. The percentage change in land use/cover from one year to the next

Land cover/use	2010	2015	2020
Forest area (ha)	220,037	188,593	180,845
%	***64.10***	***54.94***	***52.69***
Farmland (ha)	103,120	134,748	141,327
%	***30.04***	***39.26***	***41.17***
Built-up area (ha)	12,634	17,885.40	16,367.80
%	***3.69***	***5.21***	***4.77***
Water bodies (ha)	7,463.79	2,028.33	4714.74
%	***2.17***	***0.59***	***1.37***

Household interviews showed that most respondents (88%) noticed changes in the land cover and land use in the chiefdom. All the respondents indicated that the livelihood of most households in Chamuka depends on agricultural activities. Thus, most people have been expanding their farming activities in the area. In addition, the respondents indicated that there had been an increase in the number of new landowners. As food demand increases, more people have settled in the area and established new farms. A high demand for agricultural land has been from both the local and foreign communities. Another factor for an increase in demand for traditional land is urbanization. Due to rapid population increase, the towns and settlements have expanded on the customary land. The rapid population increase resulted in an excessive timber harvest for construction.

High demand and competition for the land had created other environmental problems, such as cutting down trees and losing vegetation in the chiefdom. Key informants also confirmed that the

increasing loss of vegetation, especially trees in the chiefdom. Further, community need for new land for agricultural commercialization contributed to loss of vegetation in the area. As the area has attracted local and foreign investors in the farm sector, it has resulted in massive vegetation clearing.

When asked about the causes of loss of forest area in the Chiefdom. One male Key informants in Chipempe village said. "*When you ran out of food in the house, the axe hits the tree*."

In this view, another factor contributing to loss of vegetation was a high demand for wood by the community. In order to cope with food shortages most households produced charcoal as a source of income. Charcoal production is a source of income, as well as energy among most households in the area. The community produced charcoal and sold it in the cities such as Kabwe and Lusaka where demand was high. Further, most households depend on wood energy as the area is not connected to the national grid of electricity.

Another factor contributing to loss of forest cover was expansion of farm areas. In order to increase crop yields local community expanded their crop areas. As most households were poor, they failed to purchase farming inputs like fertilizer to increase their crop yields. In order to improve crop yields households burnt vegetation. Many households burnt vegetation on their plots in order to improve soil fertility. Households used ashes to improve their soil fertility and crop yields. Most households increase their farm areas in order to increase their crop production. The community expanded their crop areas after noticing low crop yields.

One key informant in Chipempe village explained the crop area increase. *"Each year, I had to increase my field to improve my crop yields"* (KI, Chipempe village).

The other concern was the view that expanding farms and settlements have increased communal grazing land. The key informants in all four villages quickly agreed that the increase in the rearing of livestock such as goats and cattle has increases grazing land, vegetation was slowly disappearing. The discussant agreed that livestock farming was growing whilst grazing land was reducing each year.In expressing the loss of vegetation and trees, the participants in the FGDs indicated that the collection of firewood and grass was closer to their homes (with a km). For instance, one female K.I. discussant from Kasheta village recalled the abundance of trees by saying,

"We used to collect firewood from house backyards, but nowadays, the population has increased, and most of the land turned to farmland" (Female KI, Kasheta).

However, the community's expansion and subdividing of commercial farms in the area has led to massive forest clearing. Other factors that have contributed to the loss of land cover and use have been the selling of land to local and foreign investors moving into the agriculture production systems, contributing to the loss of vegetation and forest cover. The discussant also reported that prolonged droughts in the area have contributed to the loss of forest and vegetation. A focus meeting noted that trees and grass have withered due to low rainfall experienced in the area. A female interviewee in Bunda-bunda village recalled the drought of 2019/2020 by saying,

"*The drought was terrible. We could not find grass to thatch our huts. We lost our livestock due to starvation and water scarcity".*

However, the Chi-square test showed a non-relationship between land title and identified factors in the loss of vegetation (Table 2). This means that land titling has insignificant effects on the increasing demand for land in this area.

Table 3: **Perceived influence of title on loss vegetation in the study areas**.

	Household %	X^2	Degree of freedom	P-value
Expansion of agricultural areas	31	0.17	1	0.710
High demand for wood fuel and construction	12	1.61	1	0.231
Uncontrolled fire	15	2.39	1	0.420
Expansion of settlements	29	0.52	1	0.898
Loss of vegetation due to prolonged drought	5	0.35	1	0.100
Poor agronomic practices	8	0.78	1	0.4 48

3.3 Change in resource management

According to the registration and development of the Village Act, all subjects' names of chiefdom are in a land register[4]. The chief is responsible for planning and preparing the village land register. Only those whose names are in the village land register subjects are of the village/chiefdom[5]. Further, only those in the register can claim village resources such as land. Traditional leaders opposed the land government's conversion of customary tenure to leaseholds. An alternative issuance of informal certificate allowed chiefs to grant their subjects signed documentations. This informal certification authorized the chief to grant their subjects signed documents authenticating individualized land ownership without conversion to leasehold tenure.

In order to curb land pressures existing in the chiefdom, traditional leaders introduced and adopted strict land regulations in the area. The FGDs discussant asserted that the introduction of strict regulation was to reduce competition for land in the area.

Among the changes identified in the traditional leadership structure was the introduction of Village Land Advisory Boards (VLAB) under the conventional structures, as shown in Figure 2. Other cited changes in land management were the introduction of land documents, such as land registers and individual land certificates known as Customary Certificates of Land Occupancy (CCLO), funded by Civil Society Organizations. To carry on the CCLO exercise, Chamuka used the versatility of fit-for-purpose land tools such as the Social Tenure Domain Model (STDM). This was necessary through the final draft of the national land policy. The Zambian final draft of the land policy prominently provided for recognizing customary land rights through the Chiefs and promoting fit-for-purpose land administration approaches.[6] By 2015, the participants for exercise in the village were trained how to use STDM technology i.e. drawing sketch maps and the inclusion of geospatial units. Individual CCLO included information such as the holder's name and those of their family, size of the land, and location

[4] Government of the Republic of Zambia,(1998a,b)

[5] Registration and Development of Villages Act (No. 289 of 1998)

[6] (WWW. Lusakatimes. Com).

on the map using the Geographical Information System (GIS)[7]. Other changes in the chiefdom included strict regulation on land access for both local and outside communities. Strict regulation included requiring anyone who wanted land to apply following the hierarchy of the chiefdom.

3.4 Household perceptions on changes in land management

Household perception of various changes in land resource management showed that land titling was significantly associated with perceived change in resource management (Table 3). The specific factors include the VLABs (X^2= 20.86, df.1, $p < 0.001$), CCLO (X^2 = 66.08, df. 1, $p < 0.001$) and increasing regulations, such as land procedures which households followed when they needed land in the chiefdom (X^2 = 42.597, df. 1, $p < 0.001$). The household interviews identified several land-related cases that existed in the chiefdom. A land title was significant to land-related issues such as human displacement in the chiefdom (X^2 = 28.1711, df. $p < 0.001$). When asked about how the identified changes in land management have contributed to the household's tenure security, one female K.I. in Chimpempe Village said:

"*Before the introduction of CCLO, there were many cases of illegal evictions encroachment, displacements, and encroachments, but now there were fewer land disputes." (Female* KI, Chipempe Village)

Before the introduction of CCLO, chiefs and other senior village headpersons were engaged in arbitrary relocation of unused and used land. There had been a sense that villagers were not secure enough in their ownership rights to challenge traditional leaders who took land away from them. Widows and orphans seemed to have been the most susceptible groups and thus have benefitted the most from the enhanced land tenure security resulting from customary land certification. CCLO has made everyday land governance more transparent. CCLO has also reduced cases of eviction displacements and illegal settlements in the community. Traditional leaders now have up-to-date records of land ownership and the number of households in their villages. The increased transparency in land administration will reduce rent-seeking behaviour among traditional land administrators. It is also unusual for one household member and land rights holder to alienate land without approval from the rest of the land rights holders. However, in all focus meetings, there is an ominous concern about increasing formal documents. The CCLO was a local document whilst all communities recognized government leaseholds.

Similarly, transparency in customary land transactions had increased for the Bunda-bunda village discussants. The FGDs contended that the powers of government agents had reduced because they no longer had any say over expected land allocations and had to negotiate with communities over any land allocations or proposed land developments. The women discussants further noted that before individual certification, appropriation of forest products had been rampant as uncultivated private land was often an area of exploitation. The adoption of CCLO positively affects forest conservation and land management. The women and men in Chamuka explained that CCLO has discouraged communal grazing and the use of fire on private lands.

[7] Social Tenure Domain Model
This study was before the National Land Policy was approved in May 2021.

An informant in Kasheta village in Chamuka explained the importance of individual boundaries, defining that,

"Now, *even to collect wild fruits, vegetables and mushrooms on someone's land, we get permission. As a community, we respect land boundaries"*. (Informant, Kasheta).

The informants summarized that CCLO has positively affected livestock rearing because of individual growing of trees as fodder. Intensive livestock production would be the most likely result, as livestock owners have to produce grass from their fields and feed the livestock from within their land holdings. The consensus in FGDs was that CCLO had not affected communal grazing on private land, especially after the crops harvest. However, key informants contended that this could change eventually because of competition for crop residues. Crop residues were required during crop production and livestock farming.

The CCLO has resulted in afforestation on individual farms. Households have planted trees along boundaries to make them visible. All FGDs in Chamuka reported afforestation has increased with CCLO because everyone knew where their end boundaries were. Cases of encroachments have reduced because of tree planting for clear boundaries. Cutting down on trees and use of fire when harvesting honey has diminished due to CCLO. Community have stopped using fire while hunting rodents on private farms.

Table 4: Household response on perceived land title on land management.

Land administration of change	Households	%	X^2	Degree of freedom	P Value
Afforestation		8	20.860	1	<0.001***
Controlled grazing		31	2.2	1	0.135*
Agroforestry		12	66.08	1	<0.001***
Fire management		15	71.176	1	<0.001***
No charge		29	2.3	1	0.100
Not sure		5	42.597	1	<0.001***

*-statistically significant; ***-Very highly statistically significant

These sentiments echoed by the discussant in FGDs in Kasheta, who commonly reported that CCLO, including the VLABs, have made land distribution transparent. Further, CCLO has increased tenure security and fewer incidents of land abandoned in the chiefdom. However, other respondents foresaw some problems with the CCLO, as indiscriminately cutting off trees on individual plots and forests was still common among households in the chiefdoms.

4. Discussion

This study demonstrates that changes in traditional land resource management had influence the local land adjudication process, ownership, tenure security, and land use/cover pattern (Asiama & Arko-Adjei, 2022). The introduction of LABs, CCLO, and the land register has also improved land-related conflicts, allocation, and distribution in the chiefdom. When it came to equal land distribution, vulnerable groups like the women, single or widowed, culturally disadvantaged apply for land ownership. Women were free to apply for land in the chiefdom, which increased female landholders. These results echoed those from Mozambique's informal certification program, which increased land holding for all categories of people (Quan et al., 2022).

The introduction of CCLO in Chamuka also resulted in increased information sharing among the community (Tallis & Polasky, 2009; Umar & Nyanga, 2022). During the mapping exercise the community were shared information such as how to negotiate with outsiders increased community land rights .These findings are similar to Norberg and Milja (2018), who reported on how communities used informal documents to settle land disputes in the Petauke district in Zambia. Even though there were positive results in the local land adjudication process, the community still perceived CCLO as insecure, as the chief was in charge of all land distribution (Honig,2014; Chitonge et al.,2017; Hull et al., 2019). Further, this study shows that the inclusion of Geographical information on individual land, documents was a prerequisite to knowledge sharing and local communities' ability to apply formal skills (Mbile et al., 2003; Mkumbwa et al., 2019). Further the acquired skills such GIS to map land, cannot be discounted in land-improved land management (Duvail et al., 2006; Munshifwa et al., 2020; Umar & Nyanga, 2022).

The introduction of CCLO increased tenure security resulting in land investment (Cotula and Neves, 2007; Umar and Nyanga, 2022). The documents have empowered the villagers and protected their interests in these lands, which they depend on for their basic livelihoods. The adoption of CCLO has increased farmers' confidence level, resulting in increased use of agroforestry, fire management and animal husbandry. The land investment included growing trees on individual farms as fodder, resulting to improved animal husbandry. This study is similar to earlier studies by Delville (2002) in West Africa and (Mbile et al., 2003) in Cameron, where land certification forced livestock farmers to produced fodder for their animals and feed from within their own fields. Further, the study showed that the introduction of CCLO in Chamuka has slightly increased forest cover from 2015 to 2020. The slight increase in forest cover after 2015 due to tenure security resulted in the community confidence to invest in land, such as planting trees on plots (Duvail et al., 2006). At the time of this research, individual tree planting was ongoing in the case study. In addition, planting trees resulted in slight recovery of vegetation and forest cover in the area. (Lawry et al., 2017; Huntington and Shenoy, 2020). Security tenure contributed to the use of crop residues and controlled gazing, leading to improved animal husbandry. Holden and Yohannes (2002) in Ethiopia have highlighted that local communities' land investment, such as agroforestry, improved animal fodder and increased household economic assets.

The outcome of this case study demonstrated positive changes in the institutional arrangements, particularly between the communities and traditional authorities. The customary authority's acceptance to offer written individual informal documents, storing and managing data demonstrates improved relationships, confidence, and trust among the local community. In addition, traditional authorities and community members have equal access to the information. Thus, access to data facilitated tenure security as it facilitated an open-door policy for interactions and consultations in the planning and decision-making processes at the chiefdom level. Likewise, the use of the STDM tool improved accessibility to the data. It allowed the community to negotiate on matters related to service delivery, local investment in infrastructure, settlement planning, and development projects with authorities.

Although this improved traditional land management system, which integrates informal land management aspects, such as land registers and individual land certificates, has scored several

successes. The area experienced several challenges, such as the rapid increase of population that leads to the opening of new areas, expansion of farmland, and high demand for wood energy (Boone, 2019; Boone, 2019). All these effects are visible through the land use/cover changes and images that showed reduction of vegetarian cover searched for new areas. As population increase, more land cleared for cultivation and settlements. This study is familiar with reports by German et al. (2011) in Tanzania, Ghana and Chu & Phiri (2015) parts of Zambia, where leasehold titles issued to investors, resulted in local increased settlements and new farms. Therefore, the study observed that more than 10% of the forest cover has been lost between 2010 and 2020, mainly to agriculture and settlement, which have increased by more than 10%. Loss of forest cover in this study has provided evidence of how the commercialization of agriculture has contributed to deforestation and local communities' displacements in most parts of Zambia (Chu & Phiri, 2015; Chitonge, 2022; Oyama, 2022).

It was clear from the findings in this study that the reduction of forest cover due to factors such as increase in population and lack of alternative sources of energy (Kalaba et al., 2013). This finding has implications for improved forest management practices to reduce deforestation and increase forest productivity. Additionally, the results noted that before the introduction of CCLO, these areas had experienced rapid agricultural expansion and high frequency of droughts by Mubaya et al. (2012) and Blackman et al. (2017) in their studies in Brazil. However, even after the adoption of CCLO and strict procedures, there was still a massive loss of forest cover, and a much slower recovery rate. In this view, despite the inclusion of CCLO and LABs, the farmers expanded their land into virgin areas to compensate for low productivity and lack of alternative income (Lambin et al., 2001). Therefore, to reduce unsustainable farming methods, farmers' support should include subsided agriculture inputs that could increase household social capital (Berry, 1984; Mdee et al., 2012). Literature on the loss of forest cover among local communities maintains that local communities have remained underdeveloped as most agrarian policies have benefited the elite of society (Green, 2008; Mdee et al., 2021). Furthermore, change in agricultural policies has been regarded as being economically weak and determined by political leverage, leading to low capital among local communities (Simutanyi, 1996; Green, 2008; Hichaambwe et al., 2014). Therefore, the key to sustainable agrarian practices lies in assisting local farmers in decisions about applying different agricultural techniques that suit the environment (Cotula & Neves, 2007; Wily, 2011; Mdee et al., 2021).

Cause of land use/cover change

The outcome of the expansion of agricultural lands, urbanization and high-energy demand resulted in vegetation loss. Other identified factors contributing to the loss of vegetation were the high demand for wood energy farmland and urbanization. Due to the identified factors, the area vegetation and forest cover have been reducing year to year from 2010 to 2020.

The introduction of informal documentation may have contributed to households practicing sustainable agriculture but negatively on vegetation recovery from year to year. Woodland conversion to agricultural land may increase crop production areas while it may negatively affect biodiversity (German et al., 2011). Studies by Chu and Phiri (2015) report that agriculture expansion and growing population may take thousands out of hunger while putting pressure on the already fragile environment. Another reason is that rapid population growth results in the loss of vegetation

cover through direct means. More people cultivate their land. The forest area is quickly reducing year after year due to an increase in population and agriculture expansions.

High demand for wood energy and construction are the significant causes of deforestation, resulting in biodiversity loss. Earlier studies by Chu and Phiri (2015) reported that the growing demand for biofuel has resulted in the selection and targeting of certain tree species. Further, the demand for charcoal in urban areas has led to the clear felling of forests in charcoal-producing sites (Kalaba et al., 2013). Vegetation cover overall is declining due to the continuous deforestation rate annually.

5. Conclusions

This study examined the traditional land tenure system and its effects on land governance and land use/cover changes. Introducing of LABs, CCLO and the land register has improved land allocation and management. This new development has increased land ownership and tenure security and reduced land-related conflicts. However, this development has failed to solve loss of vegetation in the area. The areas has experienced expansion of agricultural, built-up areas, forest and a decrease in water bodies. Land use/cover changes in the landscape driven by expanded cultivated land, increased demand for wood energy and settlements in the area.

The information generated from this study could be fundamental for awareness creation among relevant stakeholders, such as community planners, decision-makers, and policy-makers. There is also a need to develop ways of reducing deforestation and reversing forest degradation while managing the long-term consequences of land-related conflicts. Repacking policy, planning, and efficiency implementation need to protect the available natural resources in the traditional settings of Zambia. Information generated from this study can apply in the region, especially in areas with similar customer tenure arrangements.

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