Forest management and conservation before and after the introduction of village participatory land use plans in the Kilosa District REDD+ initiative, Tanzania

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Abstract

The use of Village Participatory Land Use Plan (VPLUP) model as a natural resource management and conservation tool has been growing recently. This study examined the premise under which VPLUPs implementation can enhance the management and conservation of Village Land Forest Reserves (VLFRs) in the context of Reduced Emission from Deforestation and forest Degradation plus (REDD+) initiative in the Kilosa district of Tanzania. A mixed method research design, which integrates participatory community mapping (PCM), focus group discussions (FGDs), key informants interviews (KIIs), direct observations and household interviews were used in data collection. The results showed that there were significant ($p<0.05$) improvements in forest management and conservation indicators after VPLUPs implementation, and increase in the management and

conservation activities carried out by the community after the implementation of VPLUPs. There was also a significant decrease ($p<0.05$) in almost all uses of the forest after the implementation of VPLUPs. The findings provide evidence that the VPLUP model has potential for enhancing the management and conservation of forests in the context of REDD+ strategy. Thus, it is argued that VPLUP can be used as a forest management and conservation tool to facilitate the implementation of the REDD+ initiatives.

Keywords: *community perceptions, forest management, conservation, Reduced Emission from Deforestation and forest Degradation, Village Land Forest Reserves, Village Participatory Land Use Plans*

INTRODUCTION

Globally, forests form part of the largest terrestrial natural resource system and are vital for supporting ecological systems and human livelihoods. Unfortunately, these forests are exposed to deforestation and forest degradation (FAO, 2016; IUFRO, 2015). The recent estimates show that deforestation continues to occur in many countries (FAO, 2010; FAO, 2016). The largest forest area loss has occurred in the tropics and African and South American countries recorded the highest loss of forest area of about 2.8 and 2.0 million ha per year, respectively, between the year 2010 and 2015 (FAO, 2016). In Africa, for example, Nigeria, Tanzania, and Zimbabwe had the highest loss of forest area for western (410 000 ha), eastern (372 000 ha) and southern (312 000 ha) African countries, respectively (ibid). The main drivers of deforestation and forest degradation include agricultural expansion, population growth, mining and mineral exploration, forest fires, infrastructure development, natural disasters (floods and droughts), settlement expansion, pests, and diseases (FAO, 2016; Robinson, Abbers, Meshaki, & Lokina, 2013). These occurrences result in losses of biodiversity, forest structure, provision of ecosystem goods and services, and ecological functioning including climate change

(Parrotta, Yeo-Chang, & Camacho, 2016). Thus, sustainable forest management and conservation are global priorities (FAO, 2016), which can be linked to addressing deforestation and forest degradation challenges (FAO, 2016; IUFRO, 2015) while ensuring that forests provide long-term social, economic and ecological benefits (FAO, 2016). In the last decade, the Reduced Emissions from Deforestation and forest Degradation plus conservation, sustainable management of forests and enhancement of carbon stocks (REDD+) tool was introduced to trigger management of deforestation and forest degradation challenges including climate change (Bayrak & Marafa, 2016; Blom, Sunderland, & Murdiyarso, 2010; Bourgoin, Castella, Hett, Lestrelin, & Heinimann, 2013). The motivation of REDD + is to address climate change challenges under the principles of a Payment for Ecosystem Services (PES) scheme in that it focuses on rewarding community for managing and conserving their forestland to provide ecosystem services including carbon enhancement (Kronenberg & Hubacek,2013; Parrotta et al., 2016).

In an effort to address the aforementioned social-ecological and development interactions for sustainable forest management and conservation and improve forest conditions, Land Use Planning (LUP) provides one possible solution, especially in addressing deforestation and forest degradation (Bourgoin et al., 2013; Wilhelm-Rechmann & Cowling, 2013). LUP is defined as the process of allocating and zoning land to its desirable use with respect to the environmental conditions and needs of the people, and formulation of legal and administrative tools to enforce the plan (Daffa et al., 2003; World Bank, 2010). LUP regulates land uses and enforce land use restrictions that can help to find a balance among competing and contradictory land uses (GIZ, 2011). LUP in the form of Village Participatory Land Use Plan (VPLUP) creates a platform for community involvement in the process of allocating land to its desirable use with respect to the environmental conditions and development needs of the entire community (ibid). VPLUP is underpinned by the motivation of ensuring sustainable management and conservation of forest resources and community involvement in the decision-making

process. Thus, in recognizing this orientation, VPLUP has been incorporated into REDD+ initiative (Blom et al., 2010; Bourgoin et al., 2013).

Notably, in Tanzania, like in other developing countries in the tropics that are implementing the REDD+ initiative, LUP in the form of VPLUP has been embedded in the REDD+ initiative (Bourgoin et al., 2013; Robinson et al., 2013). According to Tanzanian policies, the implementation of REDD+ is built on the principles of Participatory Forest Management (PFM), which is buttressed by the VPLUP tool (Kajembe, Silayo, & Vatn, 2015; Robinson et al., 2013). The PFM framework comprised of two pillars, namely, Joint Forest Management (JFM) and Community Based Forest Management (CBFM). JFM involves the management of forests, mainly the National Forest Reserves, with an agreement between the government and the local community, while CBFM involves exclusive management of forests, particularly the Village Land Forest Reserves (VLFRs) under full power of the community (URT, 2008; Kajembe et al. 2015).

In the recent REDD+ initiative under CBFM approach involving VLFRs in the Kilosa district of Tanzania, the establishment of VPLUPs preceded the implementation of REDD+ (Kajembe et al., 2015). VPLUPs were perceived to be building blocks for facilitating the implementation of REDD+ by limiting the drivers of deforestation and forest degradation to achieve sustainable forest management and conservation. The premise of VPLUPs relies on secure forestland tenure, reduce land use conflicts, and facilitate forest management and conservation activities (KDC, 2010, 2011a, 2011b, 2011c). However, since VPLUPs implementation, the experience gathered so far is still limited in scope and thus information on its effectiveness in managing and conserving VLFRs is limited. Moreover, previous evidence points to improved forest management and conservation of forest reserves under community management in different parts of Tanzania, as elsewhere in Africa and Asia (Bowler et al.,2012; Gobeze, Bekele, Lemenih, & Kassa, 2009; Kipruto & Watanabe,2016; Kumar, Jurgen, Klaus, & Abdus, 2012; Lemenih, Claire, & Yvan,2015; Mbwambo et al., 2012; Robinson &

Lokina, 2011). Yet, this evidence has not been tested in the context of the REDD+ initiative, and has not been linked to VPLUPs in particular. Thus, in recognizing the importance of REDD+ in climate change mitigation, this study aimed to assess if the introduction of VPLUPs has enhanced the management and conservation of VLFRs under the REDD+ initiative in Kilosa district.

Specifically, the study was conducted to answer the following research questions: i) how does the community perceive the management and conservation of forests before and after VPLUPs under the REDD+ initiative?; ii) what are the forest management and conservation activities before and after VPLUPs under the REDD+ initiative?; iii) how willing is the community to participate in forest management and conservation activities after VPLUPs under the REDD+ initiative?; and iv) what were community's perceptions on the use of the forest before and after VPLUPs under the REDD+ initiative?

MATERIAL AND METHODS

Description of the study area

The study was conducted in the Rubeho Mountain Forest part of the Eastern Arc Hotspots Mountain Forest Ecosystem, one of the target areas of the REDD+ initiative in Kilosa district. The district is in Morogoro region in Tanzania, located between 6°00′ and 8°00′ S latitude and 36°30′ and 38°00′ E longitude (Figure 1) at an altitude ranging from 550 m to 2 200 m above sea level (a.s.l.) (Kajembe et al., 2015; KDC, 2012). The district covers a total area of 1 424 500 ha, which is approximately 20% of the total (7 062 400 ha) land area of the Morogoro region. The district is home to a population of 1 438 175 (URT, 2013) and, on average, it receives between 500 mm and 1 600 mm of rainfall annually. The rainfall pattern is bimodal, with long rains from February to May, and short rains from October to December. The annual average temperature ranges between 25°C and 30°C.

The major economic activity in the district is agriculture, and the farming system is characterized by smallholder farmers and a mixed crop system (Kajembe, Silayo, Adam, Mwakalobo, & Mutabazi, 2013). The main food crops grown in the district include maize, rice, millet, cassava, beans, bananas, and cowpeas. Cultivated cash crops include sisal, cotton, coffee, wheat, cashew nuts, coconuts, sugar cane, and tobacco (Kilosa District Council (KDC), 2012; Mutabazi, Kajembe, Silayo, & Mombo, 2014). The average annual income per household (cash and subsistence) is less than 1 000 USD, especially in the REDD+ project area (Vatn, Kajembe, Mosi, Nantongo, & Silayo, 2017). The vegetation in the district is classified as Miombo woodland (Shishira, Yanda, Sosovele, & Lyimo,1997) and covers about 40% of the total land area in the district (Benjaminsen, Maganga, & Abdallah,2009; Kilosa District Council (KDC), 2012). However, the forests are subjected to deforestation and forest degradation mainly due to shifting cultivation, wildfires, charcoal production, timber harvesting, firewood collection, and livestock grazing (Forrester-Kibuga & Samweli, 2010; Merger, Held, Tennigkeit, & Blomley, 2012). For example, in the REDD+ project area, in 10 years before the introduction of REDD+, these drivers of deforestation and forest degradation had resulted in the annual deforestation rate of about 0.35% (Merger et al., 2012).

Description of the Kilosa district REDD+ initiative

The Kilosa REDD+ initiative was implemented starting in 2009 and ending in 2014 as part of the big project known as "Making REDD+ work for Communities and Forest Conservation in Tanzania". The other part of the project involved the Lindi district of Lindi region. The Kilosa REDD+ initiative was implemented by the non-governmental organization, a Tanzania Forest Conservation Group (TFCG), in collaboration with Tanzania Community Forest Conservation Network (MJUMITA), the Kilosa district council, and the local community (TFCG, 2012; Vatn et al., 2013). The project was financed by the Government of Norway through the Royal Norwegian Embassy with a total amount of NOK

41.40 million. The initiative aims to manage and conserve VLFRs through CBFM regime and ensuring that forests serve as a platform for carbon storage and sequestration, and community's livelihoods as well as enhancing local level governance institutional arrangements (TFCG, 2012; Vatn et al. 2013; Kajembe et al. 2015). It also aims to change from the free access to forest to a more regulated access. The implementation process of REDD+ in the district adopted a participatory approach in line with the principles of obtaining "Free Prior and Informed Consent" (FPIC) that emphasizes transparency (communal orientation, communal consent and communal participation) (Forrester- Dyngeland, Vedeld, & Vatn, 2014; Forrester-Kibuga, Nguya, Chikira, Luwuge, & Doggart, 2011). During the five years of the implementation of REDD+, the initiative had established and approved the VPLUPs, VLFRs and associated by-laws at district level. At the time of data collection, only Dodoma Isanga village had acquired village land certificate and no VLFRs had been gazetted yet, but they had agreed to start enforcing the VPLUPs and associated by-laws. In addition, trial carbon payments were already made to the participating villages (For example, in the study villages: Chabima = 14 510.48 USD, Dodoma-Isanga = 8 307.45 USD, Kisongwe = 10 493 USD and Mfuruni = 4 010 USD) (Dyngeland & Waized, 2013; Kajembe et al., 2015). As "leakage", "permanence" and "additionality" are core to REDD+, the establishment of VPLUPs and income generating activities such as beekeeping, conservation agriculture, village community banks (VICOBA), sustainable charcoal and chicken rearing were geared towards addressing "leakage" and ensuring "permanence". The trial carbon payments were meant to address "additionality". The carbon payments are made only for carbon emission reduction/carbon enhancement (Robinson et al., 2013). Currently, the REDD+ initiative has been handed over to the village governments and the Kilosa district council to oversee the implementation and provide technical support. In addition, MJUMITA provides advocacy to village land use and natural resources committees, and look for opportunities for potential carbon market which relies on "voluntary market".

Research design and sampling procedure

The study adopted a mixed method research design, which allowed the collection, analysis, integration and interpretation of data based on both qualitative and quantitative approaches (Creswell, 2014). Multi-stage sampling procedures, which involved more than one stage in sample selection, were used to select the sample household for the study. A purposive sampling was used to select four villages (Chabima, Dodoma Isanga, Kisongwe and Mfuruni) from the 12 villages participating in REDD+. The rationale for using a purposive sampling technique was to ensure that the selected participants had an extensive knowledge of the research topic/issues and that both male and female members were represented. A list of households of each village was created, based on information from the village registers provided by village leaders. From the four villages, a total of 328 households (from a total of 1826 households) were randomly selected for interviews (Donley, 2012). Purposive sampling was also adopted to select participants of the participatory community mapping (PCM), focus group discussions (FGDs) and key informant interviews (KIIs) (Donley, 2012; Bless, Higson-Smith, & Sithole, 2016).

Data collection

Data were collected between July 2016 and January 2017 by the researcher and experienced field assistants. Quantitative data were mainly collected using household interviews through questionnaires administered directly to the respondents. Qualitative data were collected with the use of PCM, FGDs, KIIs, direct observation and household interviews (mainly open-ended questions). Two approaches (quantitative and qualitative) were used to collect the same data for the purpose of the triangulation and verification of the data, thereby increasing the validity and reliability of the research results (Donley, 2012; Bless et al. 2016). Data collected were on: i) community perceptions on management and conservation of forests before and after the implementation of VPLUPs; ii) community perceptions on forest management and conservation activities before and after the implementation of VPLUPs; iii)

community's willingness to participate in forest management and conservation activities after the implementation of VPLUPs; v) community's perceptions on the use of the forest before and after the implementation of VPLUPs.

Data analysis

Data analysis involved both quantitative and qualitative techniques. Quantitative data, mainly obtained through questionnaires, were analyzed using the statistical package for social sciences (SPSS) version 24 for descriptive, detailed means comparison and rank tests. Similarly, Microsoft Excel version 2016 was used for computing the weighted mean (WM). A p-value (probability value) of ≤ 0.05 was considered statistically significant for inferential quantitative data analyses (Pallant, 2013; Bless et al. 2016). Table 1 below shows the main issues analyzed and their related analytical techniques used (Pallant, 2013; Bleyer, Kniivilä, Horne, Sitoec, & Falcãoc, 2016). Qualitative data obtained mainly from PCM, FGDs, KIIs and direct observations were analyzed using content analysis techniques focusing on the content, underlying themes and meaning of text (Donley, 2012; Bless et al., 2016).

Table 1: Main issues analyzed and their related analytical techniques used

Issue number	Main issues analyzed	Measurement level and type	Analytical tool/technique
1.	Community perceptions on the management and conservation of forests before and after the implementation of VPLUPs (management and conservation indicators)	Ordinal - five point Likert scale (5= very high, 4= high, 3= neutral , 2= low, 1= very low)	• WM • Rankings • Wilcoxon signed rank test (before and after VPLUPs)
2.	Forest management and conservation activities before and after the implementation of VPLUPs (Activities)	Nominal	• Descriptive statistics (frequencies and percentages) • McNemar's test (before and after VPLUPs)
3.	Community's willingness to participate in forest management and conservation activities (willingness)	• Nominal (willing and unwilling) • Single dichotomous variable	• Descriptive statistics • Binomial test
4.	Activities that the community is willing to participate (Activities)	Nominal	Descriptive statistics
5.	Community perceptions on the use of forests before and after the implementation of VPLUPs (Forest uses)	Nominal	• Descriptive statistics • McNemar's test (before and after VPLUPs)

Note: The ranking was then done by the grouping of the WM into five groups (very low – VL = 1.00–1.79, low – L = 1.80–2.59, moderate – M = 2.60–3.39, high – H = 3.40–4.19, very high – VH= 4.20–5.00) (Pimentel, 2010).

RESULTS AND DISCUSSIONS

Community perceptions on forest management and conservation indicators/variables before and after the introduction of VPLUPs

The results in Table 2 show respondents' opinion of management and conservation indicators before and after the introduction of VPLUPs in the study area.

Table 2: Opinions regarding forest management and conservation indicators before and after the introduction of VPLUPs

Indicator/variable	Before VPLUPs (2010)	After VPLUPs (2016)	Wilcoxon Test
	WM	WM	P-value
Forest boundary conflict	2.82 (M)	2.20 (L)	0.000*
Frequency of accessing forest	3.77 (H)	1.96 (L)	0.000*
Frequency of wildfires	3.46 (H)	1.99 (L)	0.000*
Rate of deforestation (tree clearance in forest)	3.90 (H)	1.91 (L)	0.000*
Forest regeneration	2.21 (L)	4.10 (H)	0.000*
Forest benefit (goods and services)	2.22 (L)	3.97 (H)	0.000*
Presence of wild animals	2.74 (M)	3.38 (M)	0.000*
Conversion of forest to other land uses	3.40 (H)	2.12 (L)	0.000*
Change in forest boundary	2.54 (L)	2.63 (M)	0.614^{ns}
Watershed protection	1.66 (VL)	4.43 (VH)	0.000*
Grazing in the forest	2.67 (M)	1.79 (VL)	0.000*
Villagers' awareness of forest management and conservation	1.87 (L)	4.32 (VH)	0.000*
Villagers' involvement/participation in forest activities	1.77 (VL)	4.37 (VH)	0.000*

Note: WM = Weighted mean; VL = Very low; L = Low; M = Moderate, H = High, VH= Very high; * = Significant at 0.05; ns = Not significant at 0.05

A significant ($p < 0.05$) increase was observed in forest regeneration, presence of wildlife, watershed protection, forest benefits, villagers' awareness of forest management, and villagers' participation in forest activities. This result was also confirmed during various discussions. For example, it was explained that: *"Before LUP, any villager could access the forest anyhow, but since*

LUP was introduced, access to various land uses, including forests, is controlled. As such, we can now hear the animal and bird sounds that were heard a long time ago".

Such kind of wildlife mentioned include Antelopes, Baboons, Monkeys, Bushpigs and Frogs. This implies that the forest is recovering and becoming repopulated with wildlife.

The observed increase in forest regeneration and wildlife imply an improved biodiversity status/value in the area. The improved forest regeneration also implies that the forest has the capacity to regenerate naturally after being disturbed and there are no further disturbances in those areas. This indicates a potential for the provision of ecosystem services, particularly carbon enhancement, which is linked to the REDD+ initiative. In addition, it is likely that the increase in wildlife could be explained by the capacity of forests to create habitats for wildlife (successional habitat) (Ndang'ang'a, 2008; Hazard-Daniel, Hiesl, Loeb, & Straka, 2017). Successional habitat also holds potential for the beekeeping intervention in REDD+ villages as a forest enterprise activity. Thus, attention should be given to such emerging issues in the area in order to sustain the efforts of the community to conserve the forests. Receiving increased benefits from the forests imply that communities can rely on the forests to produce goods and services to them in order to sustain their livelihoods, and this in turn motivates them to participate in conservation issues. Also, increased watershed protection as an environmental service could imply an increase in water availability and discharge on the streams and rivers in the area, which is necessary to ensure water supply to the community. Signs of watershed protection, manifested in forests, were evident in the increased water flow in the streams, as reported during various discussions. Furthermore, villagers' increased awareness of forest management and participation in forest activities imply improved human capital and forest governance. However, the observed low awareness of forest management and villagers' limited involvement/participation in forest activities before VPLUPs imply that the community has been poorly involved in forest management practices before the establishment of VPLUPs. These findings partly support a study by

Hart et al. (2014), conducted in the Southern Highlands of Tanzania, who observed increased annual stream flow and wild animals and the regeneration of natural vegetation.

A non-significant ($p > 0.05$) increase in change in forest boundaries was observed, implying improved land use governance, especially related to compliance to land use boundaries. This could also be attributed to the fact that the few remaining activities do not necessarily destroy and/or change the forest boundaries. Furthermore, the few villagers who indicated changes in forest boundaries might have referred to the setting/marking of land use boundaries that occurred during the LUP process, where land use boundaries including forest boundaries had to be marked based on the proposed boundaries.

A significant ($p < 0.05$) decrease was observed in forest boundary conflicts, frequency of accessing forests, frequency of wildfires, rate of deforestation (tree clearance in forest), conversion of forest to other land uses, and grazing in the forest. This result was also supported during various discussions, for example, it was explained as follows: "*Before VPLUP, frequency of access to forest was high, anyone could access the forest to cut trees at any time but now the forest boundaries are well demarcated and access to the forest is restricted, thus the frequency of accessing and use has declined and disturbed areas are now recovering.*"

"*VPLUP have allocated areas for agriculture. This has reduced the number of people who encroach forest for agricultural practices."*

"We are happy that at least most of the land is now used based on the allocations made during VPLUP process."

Reduced vulnerability of these aforementioned forest indicators implies a decrease in people-forest interaction, which is a good indicator for achieving forest management and conservation. Lambin et al. 2001; Furusawa, Sirikolo, Sasaoka, & Ohtsuka, 2014) noted that people-forest interaction results into ecological and social change.

The result indicated that forest benefits (goods and services) have increased after the implementation of VPLUPs, despite reduced accessibility to forests. This could be explained by the restricted access, which promotes availability of goods and services. It is possible that the villagers perceived this because they had seen increased availability of forest products in the VLFRs. In addition, other benefits, like rainfall, temperature regulation and water discharge on the streams, as observed by villagers, do not necessarily require direct access to the forests. Matsvange, Sagonda and Kaundikiza (2016) suggested that limited access to forests is a positive development because it results in better forest conservation and increased ecosystem goods and services.

These findings are somehow contrary to those of the study by Kaswamila (2006) in Northern Tanzania who observed both an increase in the level of land use conflicts and forest encroachment after the introduction of LUP and the study by Walwa, (2017) in Southern Eastern Tanzania who observed the former. This difference may be explained by insufficient participation of the stakeholders in the implementation of the plans in northern Tanzania (Kaswamila, 2006; Walwa, 2017). Regarding forest accessibility, Ghazoul, Butler, Mateo-Vega and Koh (2010) noted that if the local communities are denied access to the land they manage and depend on, they become, so called, VPLUPs refugees. However, in these VPLUPs in the context of REDD+, villagers are not denied access to the land resources; instead, access is regulated for sustainable use of the land resource. For example, the harvesting of forest resources happens with the knowledge of the status of the forest and the sustainability of harvesting is based on the harvesting management plan of the forest.

In general, these findings demonstrate how the intervention with VPLUPs under REDD+ has positively influenced the management and conservation of VLFRs in the study area. In addition, these results can partly justify the perceived purpose and importance/benefits of VPLUPs noted during various discussions. These include demarcating village land, reducing land use conflict and improving management and conservation of forests, which can be linked to reduced forest encroachment, land

use conflicts and frequency of access to forests. Other studies in Western (USAID, 2014) and Southern Highlands of Tanzania (Hart et al. 2014), have reported good performance of land use plans in the management and conservation of forest resources.

Community perceptions on forest management and conservation activities before and after the introduction of VPLUPs

The main forest management and conservation activities that the community were involved in before and after VPLUPs intervention under the REDD+ initiative were explored (Table 3). The McNemar's test results in Table 3 revealed that there was significant ($p < 0.05$) changes in all forest management and conservation activities, with the exception of tree planting, for which the difference was not significant.

Table 3: Main forest management and conservation activities before and after the introduction of VPLUPs

Activities	Before VPLUPs (2010)		After VPLUPs (2016)		McNemar's Test
	Frequency	Percent (%)	Frequency	Percent (%)	P-value
Fire fighting	123	41.0	280	93.0	0.000*
Forest patrols	76	25.3	295	98.0	0.000*
Training/workshop/meeting	15	5.0	270	89.7	0.000*
Forest boundary maintenance	15	5.0	233	77.4	0.000*
Tree nursery activities	14	4.7	172	57.1	0.000*
Tree planting	6	2.0	8	2.4	0.791^{ns}

Note: McNemar's Test analysis of for paired categorical data, * Significant at 0.05; ns = Not significant at 0.05

These changes were also reported during various discussions. The positive significant changes in forest-related activities imply that intervention with VPLUPs has enhanced forest management and conservation activities under REDD+. This can also be justified by the results of various discussions on the perceived purpose and importance of VPLUPs for improving forest management and conservation. However, the slight, insignificant increase in the villagers' tendency to participate in tree planting could mean that the intervention may not have influenced the tree planting behavior of the community. The observed nursery tree activities taking place might only be executed by those few people who were trained by the TFCG in nursery activities but are not interested in planting trees. It could also be possible that the seedlings produced are for selling and planting in areas outside the study area. The implication of this is that an effort is needed to change villagers' attitudes towards tree planting on farms and/or woodlots for their own use to reduce pressure on VLFRs, which is potentially a motivation of REDD+.

Community's willingness to participate in forest management and conservation after the introduction of VPLUPs

Considering community's willingness to participate in the forest management and conservation activities, a significant (Binomial test, $p<0.05$) majority (89.1%) of the respondents were willing to embrace several activities, while a few (10.9%) were not. Table 4 shows the activities in which the villagers were willing to participate.

Table 4: Community's willingness to participate in the forest management and conservation activities

Activities	Frequency	Percent (%)*
Training/workshop/meeting	193	72.0
Fire fighting	191	71.3
Forest patrols	182	67.9
Tree nursery activities	156	58.2
Forest boundary maintenance	146	54.5
Tree planting	4	1.5

Note: * = percentage based on multiple responses

The results showed that more than 50% of the respondents were willing to participate in certain activities, with the exception of tree planting for which the willingness to participate was very low (1.5%). This willingness to participate in forest management and conservation activities can also be linked to the previous results on the increased forest management and conservation activities after the introduction of VPLUPs. These results were also confirmed during various discussions and the discussants expressed, for example, that despite the reduction in the frequency of wildfires, it was still a problem in both their farms and forests. While the community was now more willing to be involved in wildfire prevention and fighting, the challenge was to identify those people who set fire to the forest. In line with this, it was narrated that: *"As we are talking now, last month we went to stop fire which happened in VLFR and we didn't identify the person who set it."*

These results indicate villagers' support for forest management and conservation activities, which is necessary for achieving a common goal of VPLUPs and VLFRs. The results could also be an indication of the good performance of VPLUPs and VLFRs under the REDD+ initiative and that the villagers are motivated to participate in sustainable forest conservation activities. Specifically, as the

villagers are provided with forest security of tenure through VPLUPs, they are motivated to conserve the forests. Within the property right theory, security of tenure is linked to investment, careful management of land use and land productivity (Sjaastad & Bromley 1997; Holden & Otsuka, 2014). Generally, it can be hypothesized that villagers' perceptions on the performance of VPLUPs and VLFRs influence their willingness to participate in sustainable forest management and conservation activities.

However, Stern (2000) in Nkambule (2016) cautioned that people's willingness to participate in conservation practices does not always manifest in their actions. This could be true as participation in forest management and conservation are mostly voluntary and unpaid. It can be hypothesized that the community would be interested to participate in sustainable forest management and conservation practices as they would benefit from this participation. This again emphasizes the need to enhance non-carbon fund benefits under REDD+. Gross-Camp, Martin, Mcguire, Kebede and Munyarukaza (2012) noted that if the community believe in the initiative, giving it a legitimacy beyond the economic incentives, it is likely to be sustainable.

Overall, these results show that villagers are participating significantly more in forest management and conservation activities than before, and are more willing and motivated to participate in these activities. As noted by the villagers, the use of participatory approach in line with the principles of FPIC, expected conservation outcomes, income generating activities and carbon payments motivated them to participate in the activities of the initiative. However, while some villagers admitted that carbon payment was small, others were somewhat happy about it. At the same time, it seems that they were not told that it was a trial payment, which is a weakness and may pose future risks in the implementation of the REDD+ initiative in the area. Other motivations were the promised benefits such as security of tenure including village land certificate and individual customary ownership of land. In addition, possible reasons for the observed low interest in tree planting could be that the project

did not emphasize tree planting or that the villagers have no tradition of planting tree. However, since they are willing to participate in tree nursery activities, it would be easy to encourage them to plant trees on their farmlands and deforested areas. In addition, continuous awareness creation about the potential benefits and magnitude of the tree products would improve their attitudes towards tree planting. Other studies elsewhere in Africa showed villagers' willingness to participate in forest management and conservation activities, including tree planting (Kobbail, 2012).

Community perceptions on the use of forests before and after the introduction of VPLUPs

The results in Table 5 show that despite VLFRs' use for various purposes, the implementation of VPLUPs has significantly (McNemar's test, $p < 0.05$) altered the extent to which the community uses forest resources. In addition, the McNemar's test showed a significant ($p < 0.05$) decrease in all identified uses of forests after VPLUPs were introduced, with the exception of beekeeping practices, which significantly ($p < 0.05$) increased.

Table 5: Use of forests before and after the introduction of VPLUPs

Uses	Before VPLUPs (2010)		After VPLUPs (2016)		McNemar's Test
	Frequency	**Percent (%)**	**Frequency**	**Percent (%)**	**P-value**
Pole	291	96.7	134	44.5	0.000*
Timber	277	92.0	156	51.8	0.000*
Firewood	276	91.7	150	49.8	0.000*
Farming	264	87.7	50	16.6	0.000*
Wildfood (eg. berries, mushrooms)	242	80.4	167	55.5	0.000*
Charcoal	234	77.7	122	40.5	0.000*
Medicine	215	71.4	101	33.6	0.000*

Hunting	206	68.4	58	19.3	0.000*
Grazing	170	56.5	32	10.6	0.000*
Beekeeping	71	23.6	198	65.8	0.000*

Note: McNemar's test analysis for paired categorical data, * significant at 0.05

This observed pattern also confirmed the result, which showed that accessibility to forests had reduced after the introduction of VPLUPs. Similarly, the reduced use of forest was confirmed during various discussions. In addition, it was mentioned that the forest is used for research and tourism activities as well as for "ritual practices" commonly known by the community as "*matambiko*". Given the social value attached to "ritual practices", it was recognized in VPLUPs and could be linked to sustainable forest management and conservation. In this context, people feared punishment from their "followees" (whom believed to have power to affect the course of their events/actions) by destroying the areas with ritual value/importance and often accessibility thereof is strictly restricted by asking permission from their "followees".

The discussants further indicated that reduced use of the forests after VPLUPs could be linked to an effort to enforce restrictions on land use and forest by-laws, although it is still a challenge, as reported during various discussions. These by-laws include rules and guidelines about who can access VLFRs and under what conditions, which activities are allowed, which resources can be utilized without permission and which needed permission and payment. Thus, it implies that access to the forest without permission is considered to be illegitimate. This arrangement positively influences the way forest users manage and use forest resources and is thus important for sustainable forest management and conservation. As noted earlier, REDD+'s regulation of access to forests means that the forests are utilized based on the management plan. According to Senganimalunje, Chirwa, Babalola and Graham (2015), access to forest products could mean that the community are provided with various livelihood resources. However, they further noted that regulated access to forests resulted in negative

social changes to the community. These included walking long distances to search for forest products that falls outside the protected area, reduced reliance on forests and turning to alternatives to forest products. The restrictions to access forests imply positive implications on forest management and conservation. Unrestricted access to forests and extraction of forest products can undermine the conservation of biodiversity and enhancement of carbon stock in VLFRs, which would negatively impact REDD+ sustainability. In addition, inadequate access control and unrestricted use of forests may result in deforestation and degradation of the forest resources (*ibid*).

Moreover, the discussants revealed that before VPLUPs, the use of forest for farming was high but that now it has been reduced. This is because the farming system prevalent in the area was shifting cultivation, which involves clearing forest areas to open up new farms. This kind of farming system has been directly linked to deforestation and forest degradation in many parts of the tropics (Forrester-Kibuga & Samweli, 2010; Lastrelin, 2010; Ickowitz, 2011; Mertiz et al. 2012; Heinimann et al. 2017). Notably, Haberecht (2009) and Heiminann et al. (2017) described shifting cultivation as a primitive and unproductive farming practice that is harmful to the environment. However, because farming is the dominant activity in the district, deforestation and forest degradation, especially in open-access forests, are likely to continue unless continued, proper implementation of VPLUPs and enforcement of by-laws are emphasized. Furthermore, people may see VPLUPs as a danger to farming practices as they have changed the farming system. This implies that future expansion of agricultural production will involve competing demands and trade-offs. Thus, a more holistic approach is needed to improve agriculture production, given that land available for agriculture expansion is limited. The current initiative on conservation agriculture in the area is a vital stepping stone to alleviate this problem; however, major challenges could include the willingness of the locals to adopt these plans, coupled with increasing population growth and the impacts of climate change.

In addition, it was observed that forest uses such as collecting firewood, medicine and food, hunting, beekeeping and cutting poles for building purposes required a permit but no payment. This implies that despite villagers' financial status, they could access the forest to at least obtain basic forest products for their livelihoods. Timber harvesting and charcoal production demand both permits and payment. However, it was reported that the harvesting of these permitted forest products could be done in accordance with a harvesting management plan to avoid destruction of the forest. The issue of payment for the harvesting of timber and trees for charcoal production (which are mainly for commercial purposes) implies that poor households are excluded from participation. Given that poor households are often highly dependent on forests and also do not have a great influence on decision-making (Blomley et al. 2017), their participation in forest management and conservation activities may be negatively impacted. Payments for harvesting timber and trees for charcoal, however, mean that the community can have a source of income, which could be used for developmental projects as well as supporting conservation issues. For example, so far, experience shows that the trial payments for carbon funds to the REDD+ project villages in the area had been partly allocated to community development activities (Delloitte, 2012). Farming practices, human settlements, livestock grazing and mining were strictly prohibited in the forests and were perceived to be destructive and would thus limit forest conservation and carbon sequestration efforts, which are important components for REDD+. Livestock grazing in forests as noted above falls under the non-permitted activities and seems to have been significantly reduced. However, in various discussions it was claimed that the Maasai sometimes, especially during dry season, brought large groups of livestock to farms and forest reserves for grazing. Apparently, the government does not intervene, and thereby potential conflict is created that will eventually hinder conservation efforts, which has already had a positive impact. Rahman and Miah (2017) noted, for example, that because farming practices are prohibited in forest areas in the context of REDD+, food security and other farming products in the community (and ultimately community

livelihoods) could be negatively impacted. Thus, as noted earlier, farming intensification/improvement is important and the agricultural conservation initiative introduced in the area is a necessary intervention.

The observed permitted and non-permitted forest uses were also noted by Vatn et al. (2013) in the same study area and by Senganimalunje et al. (2015) in other conservation initiatives in Malawi. This further indicates that this strategy might be a good way of limiting forest use and achieve sustainable forest management and conservation under the REDD+ initiative.

Furthermore, various discussions revealed that during the implementation of VPLUPs and related activities, beekeeping was among the income generation activities that was highly promoted in VLFRs. The beekeeping was regarded as a sustainable activity, which is both beneficial to the environment (it is non-destructive to the forest) and a source of income to the community. It was revealed that each village had formed a beekeeping group for honey production and some beehives were observed in VLFRs. These groups were trained in proper beekeeping practices. During various discussions, it was explained that: *"We are currently highly encouraged to implement beekeeping practices as one way of raising our income",* and *"those beehives you see is one of our initiative."*

This implies that the villagers are motivated and willing to be involved in beekeeping practices. Thus, it is important to promote this practice and link the beekeepers to the markets to ensure their income. The beekeeping as a forest-based enterprise activity has also been promoted in other conservation initiatives in Malawi (Senganimalunje et al. 2015).

Moreover, the observed greater use of forests prior to the implementation of VPLUPs implies that most of the forests were overused and forest areas were lost/deforested due to various uses. At the same time, the observed use of VLFRs after VPLUPs may imply that the forest is important to the people despite restricted accessibility to it, which has resulted in low use thereof. The use of forests by communities adjacent to them in the rural settings of Tanzania are vital to the sustainability of their

livelihoods (Turner et al. 2007; Njana, Kajembe, & Malimbwi, 2013; URT, 2015). Thus, it can be inferred that reduced utilization of the forest resources may have positive implications for sustainable forest management and conservation, and both positive and negative implications for the livelihoods of the communities. Thus, in order to establish a win-win situation, there is a need to emphasizing sustainable forest utilization, establishing alternative sources of forest products and enhancing improved agriculture and charcoal production systems. This will ensure sustainable livelihoods and VPLUPs and associated land use activities.

CONCLUSION AND RECOMMENDATIONS

This study is timely since it addresses current issues about climate change, and REDD+ in particular, and contributes to a better understanding of the existing and potential links between VPLUPs and forest management and conservation in the context of REDD+ initiative. The study showed that the introduction of VPLUPs has resulted in positive changes in forest management and conservation activities and that the community expressed their readiness and willingness to participate in these activities.

In addition, sourcing products from forests have declined after the implementation of VPLUPs and regulated access to forests based on the knowledge of the condition of the forests. This is necessary for achieving a common goal of sustainable forest management and of improving the condition of the forests under the REDD+ initiative. It can be concluded that the mechanism of VPLUPs, as it is linked to REDD+, has changed the way the community uses and manages land. The impact of this was further evident in enhanced willingness of the community to participate in forest management and conservation activities and regulated access to the use of forests. This suggests that VPLUPs are key to the implementation of the REDD+ initiative, and thus need to be promoted and supported within this framework.

However, this institutional arrangement is likely to have negative implications for the livelihoods of community, especially in relation to regulated access to the use of forests. The REDD+ initiative has introduced alternative activities as a way to compensate the community for their social and economic losses. Successful implementation of these activities presents an opportunity to reduce anthropogenic pressure on the forest thereby ensuring sustainable forest management and long-term implementation and survival of REDD+. However, as Vatn et al. (2017) noted and confirmed in various discussions, the adoption of alternative activities especially conservation agriculture and improved cooking stoves are not promising and may therefore present risks to forest conservation efforts. This is very important information and therefore urgent interventions are needed to create more awareness and support for these activities. In addition, the fact that the expected carbon payments are uncertain, further justifies the need for the interventions to offset the costs incurred by the community.

Finally, considering that the study focused on assessing the effectiveness of VPLUPs for forest management and conservation through community perceptions, this may raise a question on the actual changes occurring in the forest. Thus, we suggest the need to assess actual changes that have occurred in the forest through application of biophysical assessments (biophysical inventory/survey), remote sensing and geographical information system technologies.

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