

## Article

# Coalitions for Landscape Resilience: Institutional Dynamics behind Community-Based Rangeland Management System in North-Western Tanzania

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**Abstract:** The past few decades have seen a continuing shift of natural resource management paradigm towards multifunctional and multi-actor adaptive management in hope of achieving more resilient landscapes. Recognizing the multitude of institutional actors and their roles as well as dynamics helps to understand communal behaviour, its manifestations in the landscape and resilience under changing socioecological circumstances. We examined institutional actors and their functions and relationships in a long-standing community-based natural resource management system, the ngitili, in north-western part of Tanzania. The aim of the research was to deepen understanding on the role of institutional arrangements and their limitations in supporting resilience of community-based management system. Data was collected through group discussions and interviews in three case study villages and district level, and institutional arrangements were analysed using 4Rs framework and social network analysis. The study shows that the management arrangements have evolved with time and are based on locally negotiated roles and collaboration among bureaucratic and socially embedded village level actors. These local level actors are resource poor, which hinders collaboration and implementation of ngitili management functions. External interventions have temporarily increased management efficiency in the villages but they did not create sustained multi-scale collaboration networks to address external threats to the ngitili resources. The results show that diversified funding sources, technical support and benefit sharing mechanisms are required to incentivize sustainable resource management. For the management system to be more resilient, the existing institutional actors and their ability to adapt should be nurtured by awareness raising, wider stakeholder participation and bridging organizations.

**Keywords:** adaptive management; institutional actors; ngitili system; restoration intervention; social network analysis; sustainable land management



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## 1. Introduction

The past few decades have seen a continuing shift of natural resource management paradigm towards multifunctional and multi-actor adaptive management with hopes of achieving more resilient landscapes capable of tackling complex challenges such as landscape degradation, climate change and loss of biodiversity [1–3]. Resilient landscapes are seen as ecological systems capable of maintaining their desired structure and functioning under changing conditions together with the communities and their livelihoods capable of reorganizing and adapting to these changes for example through social learning [4–6]. The urgency to address land degradation and achieve resilient landscapes has been highlighted in the global agenda, such as the Bonn Challenge, the New York Declaration on Forests, and most recently the United Nations Decade on Ecosystem Restoration (2021–2030). The need for tackling complex environmental challenges is pronounced in communities of the global south most vulnerable due to often poor resource base, social inequalities and direct de-

pendence on natural resources for livelihoods and wellbeing [7]. Coupled with increasing local and global demand on land and natural resources sustainable landscape management in these contexts requires approaches that address multiple societal and ecological needs and stems from existing capacities of the communities as resource managers.

The shift towards multi-actor adaptive management is increasingly summed up in the landscape approach, which acknowledges the interactions between spatial scales and the diversity of actors operating in the landscape. The approach integrates earlier ideas of self-organizing, continuous learning and multiple negotiated objectives to address these complexities in landscape management and planning. The landscape approach integrates varied stakeholder knowledge, multifunctionality as well as accounts for the dynamics of socio-ecological systems [2,8–12]. The institutional arrangements embedded in the landscape are seen as instrumental part of the adaptive capacity of resilient landscapes [7]. Our current day recognition of the role of institutional arrangements in reconciling conservation and development goals in landscape management is based on numerous studies of existing socio-ecological systems. It stands on the multitude of scholarly work on the common pool resources and decentralization [13–16], forest restoration [17], community-based natural resource management [18–20] with insights coming from conceptual frameworks of social networks [21,22], institutional analysis [23], social capital [24,25], and environmental entitlements [26].

Institutions can be defined as regularised patterns of behaviour between individuals and groups of individuals in a society [27,28]. The actors in the society influence these institutions while as Jackson [29] argues they are “mutually constitutive of one another” as the actors produce and reproduce the institutions through everyday relations and social processes. In this study, we focus on the institutional actors and their relations. In line with Cleaver [30], we furthermore differentiate the actors in terms of the types of institutions they inhabit, namely between bureaucratic and socially embedded institutions. Bureaucratic institutions are formalized arrangements with clearly defined organizational structures, contracts and legal rights, whereas socially embedded institutions are based on culture, social organization and everyday practice. These two forms are not; however, mutually exclusive but can exhibit characteristics of each other [30]. Institutions and institutional actors hold several functions and roles in communities; they mobilize resources, resolve conflicts and enforce rules, manage assets and resource access, and preserve local knowledge [31,32]. They typically facilitate collaborative action and encourage a long-term view on resource utilization and community development.

Studies of the influence of institutions on management responses and outcomes often see institutions and institutional actors as multifunctional and supporting opportunistic strategies of communities in coping with dynamic environments [33]. Several studies emphasise institutional relationships while institutional outcomes are often influenced by power relations and conflicting interests of various actors in the society [23,34–38]. The school of historical institutionalism brings temporal aspect into the study of institutions and institutional relationships. Cleaver [30] for example concludes that institutions evolve through borrowing from past and present arrangements and external institutions while adapting to changing socio-political and ecological circumstances. Thus over time, the landscape may exhibit consecutive layers of legacies of former institutional arrangements and subsequently resilience of the management regimes [26].

Recognizing the multitude of institutions, institutional actors and their roles as well as dynamics helps to understand communal behaviour and its manifestations in the landscape. Our limited consideration of governance arrangements, stakeholder capacities, and individuals’ values and attributes constrains the successful implementation of management plans [39,40]. Widening scale of landscape actors and new demands urge us to consider how existing institutional arrangements adapt to these changes [8]. Hence studying how the institutional actors, both pre-existing and newly introduced, function and interact, how their sphere of influence overlap and which limitations they experience in delivering ex-

pected management outcomes, is pressing in order to understand underlying factors behind landscape management and resilience under changing socioecological circumstances.

A traditional rangeland management system, *ngitili*, in Tanzania's semiarid north-western region offers an opportunity to study institutional arrangements in a context of long-standing community-based natural resource management system. As tree-based systems *ngitilis* provide various products and livelihood sources to the communities as well as sustain underlying ecosystem processes in the semiarid landscape. Through the years, the management system has been interacting with external landscape restoration interventions and continues to be challenged by growing demand for land and natural resources as well as changing climate. Recent research on the *ngitili* management system has focused on its effects on landscape restoration such as on biodiversity and vegetation cover [41], as well as the motivations of and incentives for individual farmers and communities to adopt, restore and sustainably manage *ngitilis* [42,43]. There has been less research on the institutional actors and their functioning behind communal *ngitili* management. In our study, we examine how the communal management of *ngitilis* is organized in terms of institutional arrangements, management actors and their roles and relationships in three case study villages. Our aim is to deepen understanding on the role of institutional arrangements and their collaboration and experienced limitations in supporting the resilience of the community-based management system. Our focus is on management actors, which are perceived important to communal *ngitili* management by the village informants. The specific research questions addressed are (1) which kinds of institutional arrangements have governed and are currently governing the *ngitili* management in the study area? (2) how are the roles and relationships distributed among the *ngitili* management actors? and (3) what opportunities and limitations these actors and their dynamics have in sustained *ngitili* management? Based on the findings, we reflect on the resilience and responsiveness of the existing management actors and the institutional arrangement as a whole.

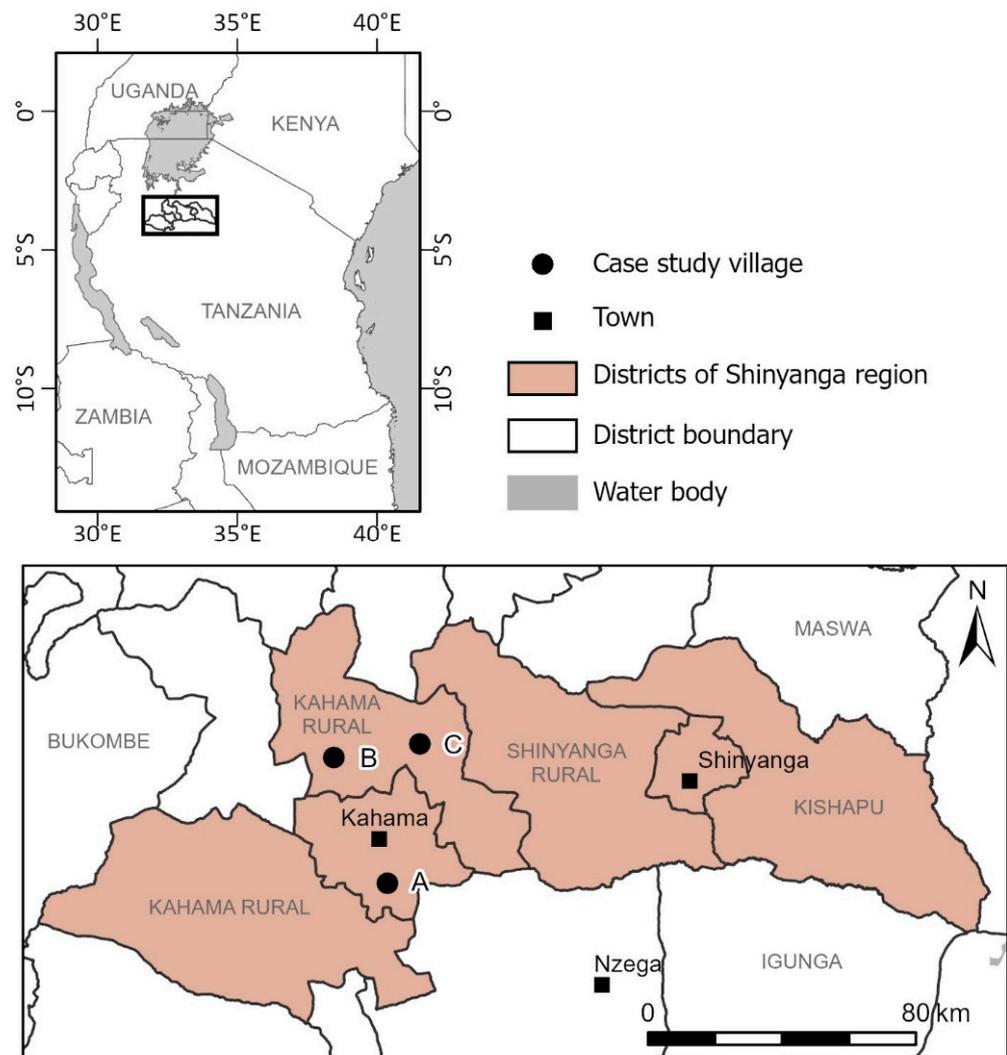
## 2. Methods

### 2.1. Study Area and Case Study Focus

*Ngitili* is an enclosure area traditionally used for seasonal grazing and fodder in the Shinyanga region of north-western Tanzania. The *ngitilis* are managed by village or subvillage administration for communal use and by organizations such as schools as well as privately by individual villagers [44]. The management intensity of *ngitilis* and the related institutional arrangements have changed over time partly as a consequence of interventions and policy reforms [45,46]. A region wide Tanzanian government-led and Norwegian supported intervention, *Hifadhi ya Ardhi Shinyanga HASHI* programme (1986–2003), promoted *ngitili* management as a part of landscape restoration and worked closely with existing socially embedded management actors, which had been unrecognized by the formal administration since the Independence in 1961 [47]. The programme has been heralded as having been instrumental in restoring the landscape of Shinyanga region partly by expanding the *ngitili* practice [48,49]. Over the years, *ngitili* management has evolved towards multifunctional tree based system, where natural regeneration and planting of trees for dry season fodder is taking place [48]. Subsequently, between 2010 and 2013, a REDD+ pilot project was carried out in Shinyanga region in 10 villages, some of which were also a part of the *HASHI* programme [50]. The project piloted a carbon payment scheme for communal and private *ngitilis* in the villages. In addition to seasonal grazing opportunities, as multifunctional systems *ngitilis* offer local communities with various non-timber forest products and act as hotspots of important regulating and supporting ecosystem services in the mostly agricultural landscape.

The study was conducted in Kahama urban and rural districts of Shinyanga region in north-western Tanzania (Figure 1). The districts consist of three administrative councils, of which our study is conducted in the Kahama town and Msalala council areas. The districts have a combined land area of 9461 km<sup>2</sup> and a population of 766,010 (according to

2012 census) which makes them relatively sparsely populated area in mainland Tanzania with 81 inhabitants per km<sup>2</sup> despite an annual population growth of 2.1% [51]. The region is semiarid and the natural vegetation is characterized by *Brachystegia* woodlands (miombo) and in the drier eastern part by acacia bush lands [52]. Large-scale deforestation and bush clearing has converted much of the land into open savannah and agricultural landscape. Agriculture and livestock keeping constitute the main livelihoods in the region with over 90% of the population living in rural areas. The population mainly consists of Wasukuma, Wanyamwezi and Wasumbwa ethnic groups. More than a third of the population lives below the basic needs poverty line [53]. The district councils are autonomous with their own budgets and revenue collection but often lack human and financial resources. They depend on central government or local borrowing for a large part of their funding (as an example, for up to 92% of funding in 2011/2012 financial year [54]).



**Figure 1.** Map of the Shinyanga region in Tanzania, East Africa showing approximate locations of the study villages A, B and C. District boundary data source: Tanzania National Bureau of Statistics/UN OCHA ROSA.

The study was conducted in three villages within 30 km radius from Kahama Town, the largest city and the administrative centre of Kahama urban district: one in each direction Northeast, South and Northwest. The villages are named A, B, and C in order to preserve anonymity of the individuals whose administrative position might reveal their identity. The study focuses on the management of communal ngitilis namely village and subvillage

ngitilis, of which management is determined less by individual owner decisions. To capture possible variation in institutional arrangements and enhance their representativeness, the restoration intervention history is considered as a differentiating factor in the case study village selection. Two of the villages (villages A and B) are so-called intervention villages, where both the HASHI and REDD+ pilot project directly worked and one is a non-intervention village (village C) without any direct environment related interventions. We, however, acknowledge that due to the extent of HASHI program in the region the non-intervention village might have been under indirect information diffusion related to ngitili management. The villages were selected based on literature, discussions with Tanzanian experts on Shinyanga, existence of communal ngitilis and accessibility. The villages are similar in terms of ecoregion, livelihoods and ethnic composition and by these characteristics represent the common characteristics of villages in the western part of Shinyanga region. Due to resource and time limitations, the number of case study villages was restricted to three. The size of the communal ngitilis in these three villages ranges from 2.3 ha to 15.5 ha (average 8.3 ha).

## *2.2. 4Rs Framework and Social Network Analysis Guiding the Study*

The study uses 4Rs (Rights, Responsibilities, Resources and Relationships) framework to conceptualize the roles and relationships of the management actors as well as to identify their opportunities and limitations in terms of ngitili management. The 4Rs framework has been used in analysing multi-stakeholder situations such as to study imbalances in capacities, dependencies among actors and to diagnose problems [55–57]. In this study, we define the resources to comprise of the financial, material and human resources of the actors and the benefits they accrue from the ngitili enclosures. The relationships among the ngitili management actors were conceptualized and analysed using social network analysis (SNA) [58]. Thus, the SNA methodology guided data collection, analysis and interpretations related to the relationships.

The 4Rs framework was chosen as it focuses on several aspects that influence resource management outcomes but at the same time is relatively concise and as such does not require an extended field data collection. The 4Rs and SNA approach, however, bring limitations to the study. The 4Rs framework and social network analysis do not directly capture the performance of the management actors and the governance system. Performance is an important factor to count in while studies in Tanzania [59] and elsewhere [60] suggest low accountability, representativeness and poor governance practices among the natural resource management actors. Due to resource limitations, the management procedures were not observed in the study and therefore the study relies on individual informants' subjective accounts. For example, since the management actors such as environmental committees are represented by individuals, the study relies on the individuals' accounts on their activities and the institutional functions. Finally, SNA depicts the informants' perceived social network, not the de facto network and recall error is always common [61]. In this study, our analysis of the network relations required the informants to remember who they collaborate with and in particular to distinguish who they collaborate with and how in ngitili management leading to two possible sources of recall error.

## *2.3. Data Collection and Analysis Methods*

We used multiple methods of data collection including interviews, focus group and informal discussions as well as multiple data sources such as secondary and primary data in order to enable triangulation. After the data had been analysed and interpreted we arranged also follow up discussions with our informants so as to discuss and crosscheck our data interpretations. Secondary data included project reports, ngitili related research literature and legislation and policy documents. Existing data on ngitili management and restoration, mainly HASHI programme documents and Tanzanian institutional history, was used to reconstruct region wide timeline of the evolution of institutional arrangements in ngitili management. Furthermore, a legislation and policy review was conducted to

identify policy stipulated national, district and village level institutional actors related to forest and land management in Tanzania. Together with the 4Rs framework detailing management opportunities and limitations, the institutional arrangements timeline was used to shed light on the adaptive capacity and resilience of the management actors.

Following the 4Rs framework the data on institutional arrangements, roles and evolution of ngitili management at a village level was collected using focus group discussions and key informant interviews. The fieldwork was carried out between April and July 2014. During the focus group discussions in the villages and at the district level, the informants were asked to identify and rank management actors in the order of importance to communal ngitili management. During the group discussions socioecological history timelines were also drawn for each village. Separate focus groups were organized for men, women, elders, youth and village actives to represent different gender, age and social status among the villagers. In village C, additional focus group discussions were organized for subvillage representatives because the village has two times more subvillages than villages A and B. In each village, the village leadership was contacted first to ask for permission to conduct the research and they assisted also in inviting people to the group discussions based on our instructions for the group composition. The discussion participants were village members who volunteered after invitations had been sent to subvillages for people to participate in the research project.

Informants in the interviews were representatives of the identified institutional actors and the interviews were conducted using a semi-structured questionnaire. Some of the informants were the sole representatives of the institutional actors, such as village executive officers, while representatives of organizations such as committees were selected based on availability and active role in the organization. The village leaders assisted in contacting the available representatives if the research team was not able to directly contact them on phone or office visit. The informants were asked about the 4Rs, constraints and history of the management body, which they represent. Furthermore, informants were asked about their perceptions on the institutional factors behind the success of the ngitili restoration and management. The discussions and interviews were conducted in English at the district level and in local languages, Swahili and Sukuma, with interpreters in the villages. Tape recorder was used when possible. In total 17 focus group discussions in the villages (5 in village A and B and 7 in village C) and one focus group discussion including with district level officers from various departments were conducted. 56 village and ward level and 11 district level key informants were interviewed. In addition, observations were made in the communal ngitilis. As the research team overnights approximately two weeks in each research village, informal discussions took place also with various community members assisting in familiarizing with the villages and crosschecking information.

The collected data on three of the actors' 4Rs (rights, responsibilities and resources) was analysed using conventional content analysis [62,63] in a coding software, Nvivo 10, and Microsoft Excel. Among the multiple functions, i.e., responsibilities, which the actors have in ngitili management, we focused our analysis to the most important ones emphasized by the informants and Andersson et al. [64]: awareness raising, rulemaking, enforcement including patrolling and sanctioning and conflict resolution. The socioecological timelines from each village were combined with the secondary data to reconstruct the evolution of institutional arrangements in the region. The social network analysis of the relationships (the last R) among the ngitili management actors was carried out using a software called UCINET 6 [65]. The boundary definition in the social network analysis was all the mentioned actors related to ngitili management. The management actors in the sample consist of actors, which operate in the village and actors, which do not operate in the village level but were mentioned by the informants as having an advocacy and information-sharing role. Some ward and district level institutions operating in the villages were not available for the interview and, thus, their social networks were not captured and information on them rely on nominated relationships [21].

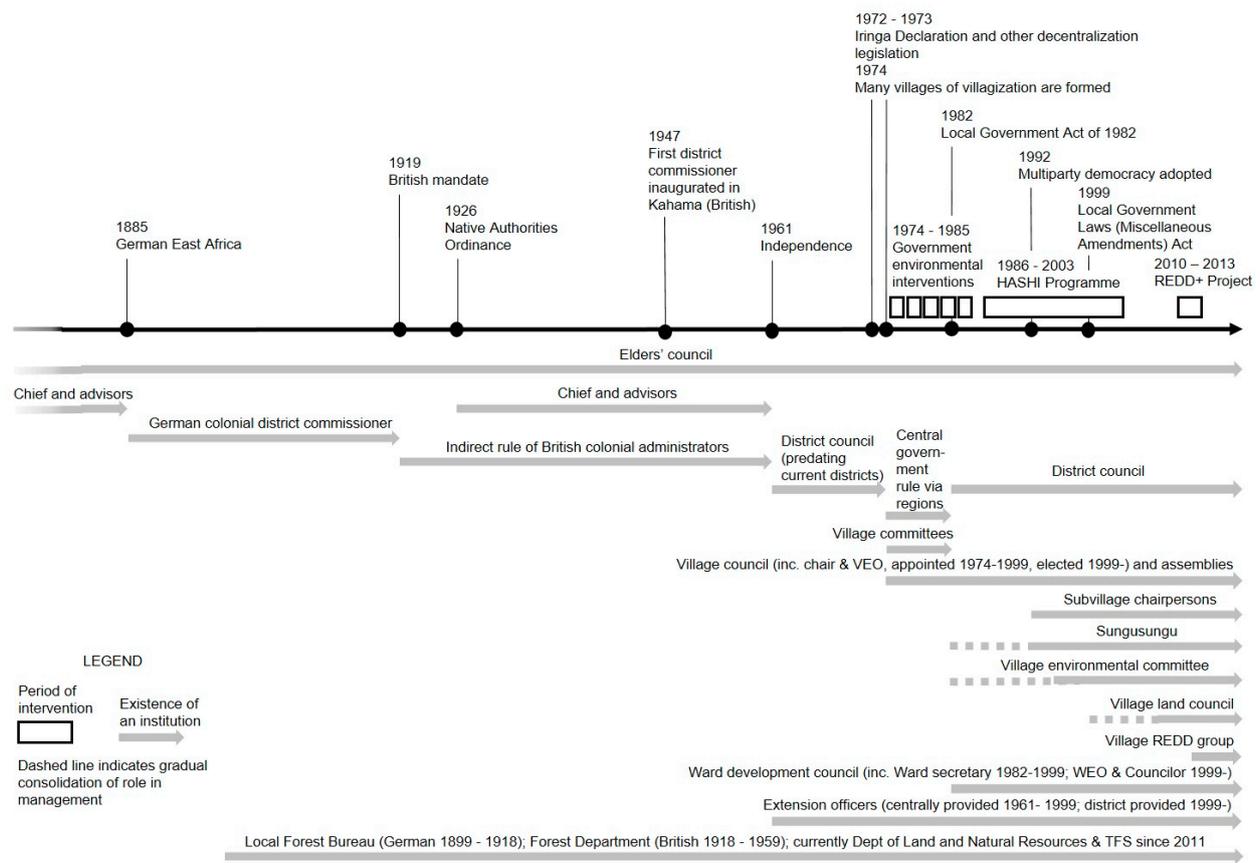
The relationship types studied in the SNA are sharing of information, decisions, work and finances. Sharing of financial resources, such as revenue sharing arrangements, is very rare among the actors, thus, it was omitted from the final analysis. Moreover, work and service relationships were combined under work sharing since data showed that informants had varying perceptions on if a task was carried out in collaboration or by delegation. The network data was typed into adjacency matrices and checked for unreciprocated relationships, i.e., ties. The descriptions of the ties given by the informants and the known formal administrative procedures were used to verify or invalidate the existence of the tie in cases where the tie was not reciprocated. The ties were treated as undirected due to the co-occurrence nature of the relationship types. The common relationship variable in 4Rs framework is the quality of relationship denoted for example as good, fair and bad (see, e.g., [66,67]). This attribute was examined in this study but it was removed as a proxy for relationship because it did not bring out differences in relationships while all relationships were described by the informants as being very good or good. Thus the degree centrality measure, i.e., the number of direct ties an actor has [22] was selected to represent the relationship variable in the 4Rs framework. A mean value of the information, decision and work degree centrality values was calculated and used as this variable. The betweenness centrality of each actor, i.e., the number of actors who an actor connects to the network who would otherwise be disconnected, and overall network density measure in each village, i.e., the number of existing ties divided by the number of possible ties, [21] were also calculated and interpreted.

Follow up discussions were organized in August 2016 in each village and at the district level. In the sessions, the findings from the 2014 study were presented to the participants in a form of data visualizations and verbal presentation in the local Swahili language (at district level in English), after which there was an open floor for questions and discussion on the findings. The researchers' data interpretations were discussed and possible implications of the findings to the ngitili management arrangements were reflected on with the participants. Participants also raised other topics to the discussion that the results incited. Feedback on the interpretations corroborated and were used to finalize the reporting of the research findings. In the villages, all the informants of the 2014 study were invited to the discussions; in the village A, the session had 10 participants due to coinciding funeral in the community, in village B, 25 participants and in village C, 35 participants. In the district feedback session, there were 24 participants from district and regional level organizations including planning, environmental, agriculture and forestry authorities and non-governmental organizations as well as village leadership representatives of each study village. We left the villages with summary visualizations of the findings in Swahili and the presentation and report based on the presentation in English to the district offices.

### 3. Results

#### 3.1. Past and Present Ngitili Institutional Arrangements

Ngitili enclosures for grazing have a long tradition in the study villages. Before Tanzania's independence they were governed by chiefs and their advisors (swa: watemi and wanangwa) as well as elders' councils (Figure 2). The elders' councils continued to support ngitili management while several other institutional actors emerged during the next decades. According to interviewed village elders as a response to population growth and increased demand for land and forest resources especially following villagization<sup>1</sup>, the establishment of communal ngitilis governed by village councils or subvillages increased. Village A established its first village ngitili in 1975 following village establishment and some years later its first subvillage ngitili. In village B the village cotton farm was turned into an enclosure as land and forest reserve in 1986 after cotton revenues had begun to fall, and in village C, subvillages led by subvillage chairpersons began to establish ngitilis in 1980's responding to increasing resource degradation and demand. The use of ngitilis were regulated with unwritten rules and sanctions, some of which are still the same as in the past.



**Figure 2.** Institutional evolution timeline. Shows the emergence of institutional actors related to natural resource management and latest environmental interventions in the context of broader institutional changes in the Shinyanga region and Tanzania [68–72].

Currently, the intervention villages A and B have village ngitilis, village A also has one subvillage ngitili. The non-intervention village, village C, has three remaining subvillage ngitilis while the other five have degraded due to lack of management or have been privatized (Figure 3). The present day institutional arrangements are similar in intervention and non-intervention villages, though the main differences are in the lack of certain village level actors in the non-intervention village (Figure 4). The environmental committee and village REDD group are not present in the non-intervention village while the establishment of both of these organizations is associated with interventions, HASHI and REDD+ respectively. The management of communal ngitilis mainly rests on the formal village or subvillage governments and the assemblies. They, however, share and allocate responsibilities to village committees as well as socially embedded actors, namely sungusungu and elders' council, in both village and subvillage level.

### 3.2. Roles of Present Day Ngitili Management Actors

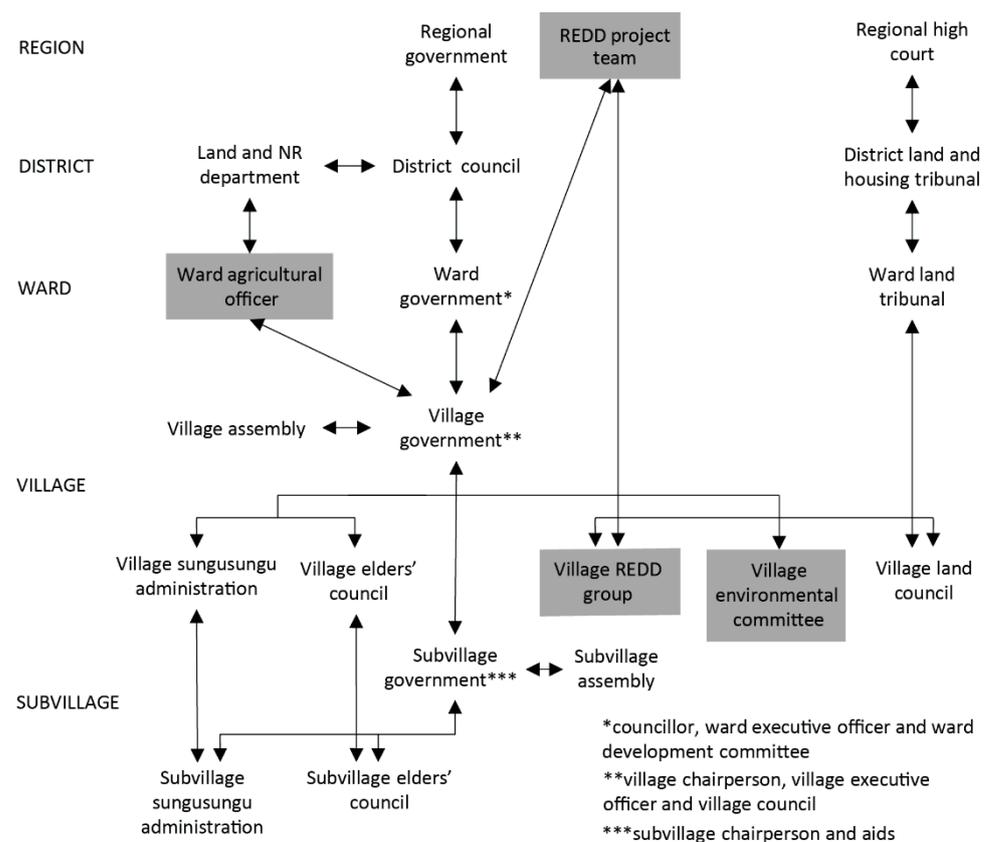
In village A and B, the village government has several responsibilities as a ngitili owner but in village C subvillage government has the ngitili owner responsibilities and village level actors are to support the subvillage (Table 1; Table S1). Most of the management actors are multifunctional with several responsibilities. The village and subvillage general assemblies have decision-making power over several management issues. Sungusungu as a socially embedded actor is among the institutions with ngitili responsibilities. They are vested with the patrolling and ngitili rule enforcement, which they adopted some years after their establishment in 1982 as part of their law and order policing. Furthermore, there exists also socially embedded institutions of reciprocity, beliefs and sanctions, which underlie formal ngitili management<sup>2</sup>. Higher-level actors have clearly less rights and

responsibilities and are mainly mobilized for action if the village actors fail to solve cases or require management support (Table 1; Figure 5). Apart from support role, the management actors at ward level act as mediators between the village and district level while district actors have supervisory role.



**Figure 3.** Ngitili vegetation in each study village. (a) Village ngitili in village A; note the traditional wooden beehive on the tree. (b) Village ngitili in village B. (c) Subvillage ngitili in village C; note photo taken early July during dryer season in Kahama district. (d) Subvillage ngitili in village A. Ngitilis are located in both flat terrain such as in photos (a,b) and in hilly rockier terrain in photos c and d. Photos by Salla Eilola, 19 May–6 July 2014.

Rights and responsibilities of the actors are mainly in balance namely the actors with highest rights have also several responsibilities (Table 1; Table S1). This balance does not exist, however, between responsibilities, benefits and resources. The management actors with the highest responsibilities receive no or little direct benefits from the ngitilis, thus, the ngitili revenue rarely acts as an incentive for the actors to fulfil their responsibilities. Besides inhabitants accessing ngitili products such as firewood, fodder and mushrooms, most of the ngitili revenue is deposited into the village or subvillage fund for use in development activities. The fine in money or in kind is, however, used as an incentive, while the arrestor, be it sungusungu patrol or any individual, receives part of the fine paid by the violator. According to the interviewed representatives, the subvillage and village level management actors operate with very limited resources, while the higher-level institutions are the ones with highest amounts of resources (Table 1). There is a common lack of funding, staff, transport, stationaries, education, and management skills. The village and ward administrations are entitled to annual budget allocation from central government but these grants are not regular. For example, by the time of the interviews, the village government of village B had not received the grant since one year ago when the Kahama district councils were reorganized. Although the district Department of Land and Natural Resources has clearly more resources than village level actors it is said to lack transport and time for supporting ngitili management.



**Figure 4.** Institutional arrangement in ngitili management in Shinyanga region Tanzania. In shaded boxes are institutional actors which exist only in intervention villages (village A and B).

### 3.3. Relationships among the Management Actors

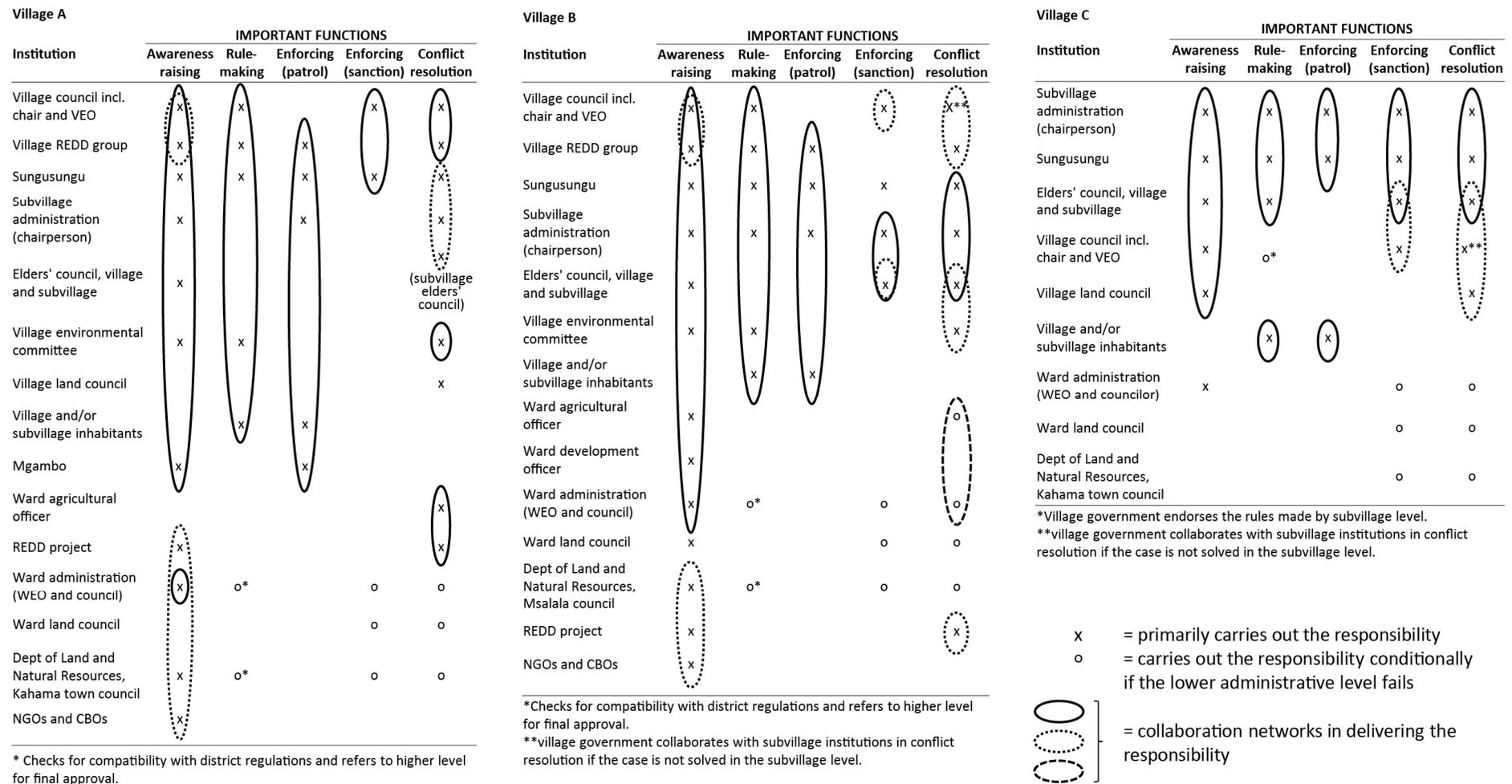
There are collaborations and linkages between the village and subvillage level actors but less with actors at the higher levels of administration (Figure 6). Based on the social network analysis the density of the networks among the ngitili management actors in the three study villages ranges between 12% to 28% (Table S2). The non-intervention village has the lowest network densities and, thus, fewer connections among the actors than in intervention villages. The important management functions are mostly delivered as a collaboration between bureaucratic and socially embedded actors in all the villages (Figure 5). In the non-intervention village, there is the least connections between the village and higher-level actors and the Department of Land and Natural Resources is said to have never worked in the village. There is also no collaboration with the ward level actors in delivering the important management functions contrary to the intervention villages (Figure 5).

**Table 1.** Institutional actors with the highest 4Rs in intervention and non-intervention villages in the study area. In brackets the number of rights, responsibilities (conditional responsibilities carried out if lower administrative level fails) and resources and the mean of degree centrality denoting to the number of relationships an institution's representative has. N value states based on how many representatives the mean was calculated.

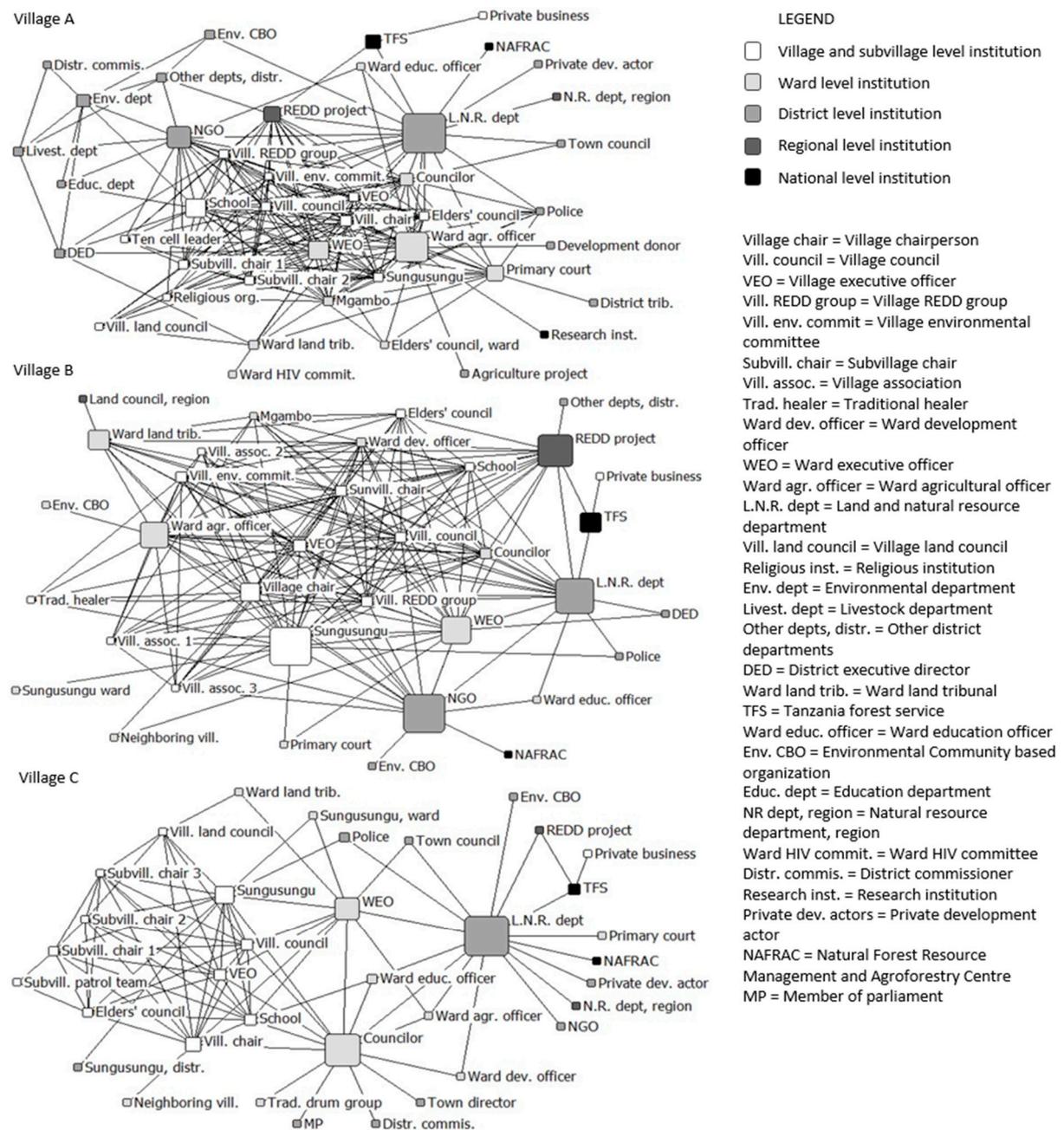
Highest Number of Rights to Ngitili	Highest Number of Responsibilities (Primary + Conditional Responsibilities)	Intervention Villages		Highest Number of Connections (Mean Degree Centrality)
		Highest Number of Benefits from Ngitili	Highest Amount of Resources	
Village government with village inhabitants (3) Village REDD group (3) Dept of Land and Natural Resources (3) Subvillage government (1) REDD project (1) Sungusungu (1) Elders' council (1) Village environmental committee (1) Ward agricultural officer (1) Ward government (1) NGOs and CBOs (1) Tanzania Forest Service (TFS) (1)	Village government (9) Subvillage government (5) Village REDD group (4) Sungusungu (4) Elders' council (4) Village environmental committee (4) Village land council (3) Ward agricultural officer (3) Ward government (2 + 3) Mgambo (2) Village inhabitants (2) Dept of LNR (1 + 3) Ward land council (1 + 3) NGOs and CBOs (1) Primary court (+ 2) TFS (+ 2)	Village inhabitants via village fund (4) Sungusungu (2) Village council (2) Village REDD group (1)	REDD project (2 million/4a, skills, education, transport etc.) Dept of LNR (money, office, education, skills) Village council (some thousands USD, office) Councilor (some thousands USD, office) Village REDD group (some hundreds USD)	Ward agricultural officer (18.7, n = 2) Village government (VEO 15.7, n = 2, village chair 16.5, n = 2, village council 15.8, n = 2) Village REDD group (15.5, n = 2) Sungusungu (15.5, n = 2) Dept of LNR (13.5, n = 2) Village environmental committee (13.4, n = 2) Ward government (WEO 14.2, n = 2, councilor 12.2, n = 2) Subvillage government (chairs 12.2, n = 3) Elders' council (11.4, n = 2) REDD project (11.2 n = 1) NGOs and CBOs (8.3, n = 8) Mgambo (7.2, n = 2) Religious institutions (7, n = 1) Ten cell leader (6.3, n = 1) School (6.2, n = 2) Police (3.8, n = 2) Ward land council (3.5, n = 2) Primary court (3.2, n = 2) Village land council (3, n = 1)

Table 1. Cont.

Non-Intervention Village				
Highest Number of Rights to Ngitili	Highest Number of Responsibilities (Primary + Conditional Responsibilities)	Resources		Highest Number of Connections (Mean Degree Centrality)
		Highest Number of Benefits from Ngitili	Highest Amount of Resources	
Subvillage government with subvillage inhabitants (3) Elders' council (1) Village government (1) Ward agricultural officer (1) Ward government (1)	Subvillage government (9) Sungusungu (4) Elders' council (4) Village government (2 + 4) Village land council (1 + 3) Ward government (2 + 3) Village inhabitants (2) Dept. of LNR (1 + 3) Ward land council (1 + 3) TFS (+ 2)	Subvillage inhabitants via subvillage fund (3)	Dept. of LNR (tens of thousands USD, office, skills, education) Councilor (some thousands USD) Village council (some hundreds USD, office)	Dept. of LNR (12.3, n = 1) Sungusungu (11.3, n = 1) Ward government (WEO 9, n = 1, councilor 10.7, n = 1) Village government (village chair 9.7, n = 1, VEO 8.3, n = 1, village council 7.3, n = 1) Elders' council (7.3, n = 1) Subvillage government (chairs 5.9, n = 3) School (3.7, n = 1) Ward agricultural officer (2.7, n = 1) Village land council (2.3, n = 1) TFS (2.3, n = 1) Ward land council (0.7, n = 1)



**Figure 5.** Institutional collaboration in the delivery of important management functions in ngitili management in the Shinyanga region, Tanzania. Important functions adapted from [65] and informant statements. The subvillage level in all the villages first try to resolve conflict and violation cases and if they fail, they take the case to the village level. In the three case study villages, none to three violation cases in communal ngitilis are brought annually to the subvillage or village governments' attention. However, several informants note that ngitili violations happen often and that the violators are not caught and cases settled. In field visits to ngitilis, the research team witnessed in various intensity signs of ngitili rule violations such as grazing and fresh wood harvesting. Ngitili violation cases have rarely been taken to higher level: informants recalled only two cases taken to ward level both in village B.



**Figure 6.** Social networks of the institutional actors in the three case study villages in Shinyanga region, Tanzania. The networks depict betweenness centrality in information sharing with the size of the node relative to the betweenness centrality of each node, i.e., each institutional actor.

The networks are quite decentralized with none of the actors having clear central role. However, information brokerage creates influential positions in the networks (Figure 6; Table S2). District level actors have the highest betweenness centrality in information sharing (Figure 6). In other words, they act as brokers of information between village level actors and those higher-level actors, which do not have direct relationship with the village level. Nonetheless, several village informants in the village A and B made statements about the troubled relations with these information brokers at district level:

*There is conflict between the villagers and the forest department [District department of Land and Natural Resources] because if you want to cut any kind of tree, even a tree on your own land, you have to get permission from the forest department.*

(Group discussion, village A)

*There are ngitilis, which were not registered by Mkuhumi [REDD+ project] because the owners were afraid that after registering, their areas will be confiscated by the government or by big private companies.*

(Men's group discussion, village B)

In practice, the ward agricultural officer, in the non-intervention village the councillor, and WEO are in the most crucial positions in terms of information sharing (with both high betweenness and degree centrality) while they are well connected, better trusted and have awareness raising and advisory role in the villages.

### 3.4. Institutional Opportunities, Limitations and Dynamics

The analysis of the 4Rs reveals that there exists supportive and undermining dependencies among the ngitili management actors. The information, decision and work sharing between village and subvillage actors makes them interdependent and strive for mutual goals. The existence of clear information brokers on ward level indicates dependency on few actors for new ideas and innovations to improve ngitili management, to mobilize resources and leverage political support from higher levels for the ngitili protection. There is an example of the lack of political leverage in the village A. Some years ago a part of the village ngitili was used by a road construction company for construction material extraction without village council approval and the extraction was stopped only after lengthy advocacy by village government and village REDD group without much support from high level. Furthermore, village actors with little revenue sources are dependent on district council for grants, which reduces their ability to plan future management and financially mitigate the effects of sudden disasters such as drought. Ngitili resources, however, have been used as an insurance in the face of drought and famine such as in village C, where in 2007 one of the subvillage ngitilis was opened for timber extraction to generate money for food while the district failed to deliver food aid to the village.

According to the informants, lack of human and financial resources constrain collaboration and fulfilment of management responsibilities by the institutional actors. Low education level among the institutional actors and subsequent poor performance and understanding of responsibilities coupled with alleged corrupt practices pose underlining challenges to the management of ngitilis. For example, in village B two consecutive VEOs had been chased out after incidences of embezzlement were revealed to villagers. What is more, several informants pointed out that local management actors often make political decisions, which serve individual instead of common interests. The management also has underrepresentation of women and village assemblies gather low attendance especially of most vulnerable social groups. In the studied villages, women's representation in the formal village and ward level management actors is 39% but only 2 out of 12 of the leader positions are held by women and elders' councils and sungusungu administration is composed only of men.

According to the informants, the most important institutional factors supporting community-based management of ngitilis is awareness raising and influencing among the community. In all the villages, informants emphasized the importance of external influence such as interventions and influential individuals in raising environmental awareness. For example in the village C, several informants stated that the current ward leadership emphasizes environmental issues much less than the previous one, of whose priorities included environment. They also highlight the need of institutional commitment to responsibilities and the provision of incentives to motivate conservation and management activities. Both HASHI and REDD+ interventions provided the villages with awareness raising on conservation importance as well as technical knowhow and material support

such as tree planting material. HASHI programme also ensured that the existing ngitili rules were written down in the villages. Apart from incentivizing forest protection through pilot carbon credit system, the REDD+ project established benefit-sharing arrangement for responsible management actors to receive some of the ngitili revenue. According to the village informants' accounts related to the interventions the establishment of both communal and private ngitilis increased and the rule enforcement was strengthened, which together with raised awareness decreased ngitili violations.

Despite the apparent positive impact of interventions on environmental awareness and management efficiency, these impacts have been limited and temporary. Some informants note that the awareness raising did not reach to all people and gradually people forgot the conservation importance. Furthermore, when new village leaders came to power, they were not always emphasizing ngitili conservation. The material and technical support given strengthened ngitili management only momentarily when it was forthcoming; for example environmental committees, main local counterparts of HASHI programme, have currently little resources and a small role in ngitili management. Furthermore, the REDD+ benefit sharing mechanism has not supplied any revenue to the management actors and community; as of August 2016 there has not been any REDD+ payments to the communities since the pilot ended in 2013.

Interventions altered institutional arrangements in the village level and temporarily influenced collaboration networks. According to the informants, collaboration and consensus among the management actors and between them and the community members are seen as prerequisites for the management to function. While HASHI programme consolidated village environmental committees, REDD+ project established village REDD groups. In village A, REDD+ project stripped away some responsibilities and all ngitili induced revenue from subvillage government and vested them on village government, which was seen at the time more able to mobilize resources and networks to protect ngitilis especially against violations caused by outsiders (often informants said violators come from outside the community). Collaboration between village and higher organizational level actors increased during the intervention due to available resources and facilitation but diminished after the interventions ended. During REDD+ project, for example, ward and district levels had active environmental and livelihood organizations providing villagers with services but which have currently decreased or stopped their activities in the villages. Furthermore, the informants recall that the interventions did not integrate district and ward level officials into the project activities and, thus, build their capacity to support the villages after the interventions ended.

In the feedback discussion, the district and regional actors recognized the lack of follow-up activities in villages and discussion between district and local level actors regarding forest and ngitili management. They agree that awareness raising and follow up most likely would support adherence to sustainable ngitili management among community members but also noted that alternative livelihood and energy options are needed in the region to reduce pressure on ngitili resources. In addition, they noted the limited collaboration between district authorities and Tanzania Forest Service, a national level agency responsible for managing government owned forests and the registering of village owned forests and for example licensing of timber harvesting. They highlighted the need for policies to be aligned to avoid contradiction especially in land and natural resource management as is happening currently. This would assist the different implementing actors to better coordinate their activities in support of sustainable resource management.

## 4. Discussion

### 4.1. Ngitili Management Shows Temporal and Relational Dynamics and Limited Higher Level Support

Our study examined institutional arrangements, management actors and their relationships in a traditional community-based natural resource management system with the aim of better understanding their role in resilient landscape management. We examined the institutional arrangements and collaboration as they are an important part of the adap-

tive capacity of resilient landscapes. First, we will discuss the management actors, their evolution, functions, and relationships, and limitations in relation to resilient landscape management. Then we reflect on how the ngitili system has coped with environmental and socio-political changes in the area and the characteristics of adaptive management that the system exhibits.

Our study shows that the ngitili management is based on locally negotiated roles and collaboration among village level management actors. The institutional timeline shows that some of these actors have existed for long, some have vanished and others have evolved later to take up ngitili management responsibilities. National policies and interventions have been instrumental in reforming institutional arrangements while environmental degradation and demand for resources have increased the need for environmental management. Despite the dynamics, the ngitilis with unwritten rules and sanctions have persisted and new actors have endorsed them creating institutional coalitions where bureaucratic and socially embedded management actors function together. The importance of these coalitions for the success of ngitili management has been evidenced also in a recent study of key governance principles related to ngitili restoration in the region [73]. While most of the actors are multifunctional, they have to coordinate collaborative delivery or delegation of management functions to avoid overlapping of responsibilities. The clear roles of the actors in the management of ngitilis eases the coordination of many ngitili management functions contributing to the sustainability of ngitilis.

In addition to horizontal village level collaboration, the management system would benefit from more vertical linkages to higher-level actors. Diverse horizontal linkages have been shown to foster social capital and cohesion needed for collective action and also to increase management efficiency [13,22,74]. In our case study villages, the diversity of horizontal linkages is realized in the daily collaboration of bureaucratic and socially embedded actors. Limited vertical linkages to external and higher level actors including district authorities, private sector, and civil society are seen hindering management efficiency and resilience. Links to and support from the higher level actors has been shown to strengthen communal management and allow policy influence by the local level actors [73,75,76]. That said, lack of trust, resources and time constrains collaboration and formation of new relations [77,78], which is also evident in our study. The villages' experiences with higher-level actors indicate the lack of long-term multi-scale and multi-sector collaboration perpetuating inability to address complex cross scale threats such as illegal resource extraction, land grabbing and climate change that undermine sustainable ngitili management.

The importance of influential individuals in mobilizing and sustaining management should be recognized and their capacity and awareness on environmental protection be ensured. In particular, actors with high betweenness centrality are in the influential positions and act as brokers of information between otherwise non-connected actors [77,79,80]. Therefore, it is imperative to ensure the knowhow, integrity and resources of the ngitili management actors in these central positions: the district and ward officials as well as the village council, who are closer to the community. The availability of extension officers for example has been shown to be important for the adoption and preservation of private ngitilis in a study among farming households in the region [42]. Our study together with other studies in community-based resource management have also observed that influential individuals and leadership not only actors in influential network positions have an effect on management outcomes given that they possess vision and understanding of the importance of environmental protection [81–84].

Lack of resources and incentives are pertinent limitations in ngitili management but opportunities to overcome these limitations exist. The HASHI and REDD+ pilot interventions mobilized momentarily ngitili management with inputs, benefit-sharing mechanism and awareness raising. However, resource scarcity, impunity and corruption that exists in villages raises the question of how the system ensures that actors, which do not directly benefit from ngitilis carry out their responsibilities especially during times of no outside support. Regular patrolling in the ngitilis to prevent illegal activities is one

key responsibility that is undermined without appropriate compensation for the effort. This concern is substantiated also by another study that highlighted the enhancement of incentives, equitable benefit-sharing mechanisms and accountability instruments as crucial for sustained ngitili management [73]. The frequent occurrence of ngitili violations are a sign of failings in the management responsibilities and rule enforcement. What is more, the small area and low tree volume of most of the communal ngitilis does not offer high revenue opportunities to incentivize management. The lack of incentives and financial resources is recorded in literature as a common natural resource management challenge [2,17,83–85]. Thus, it is important to note that motivation of community members and management actors to work for common goals and not for self-interest can manifest in different forms [15]. In the case of the studied ngitili management actors, incentives can materialize in the forms of diversified revenue sources, access to credit services, formalized land rights as well as awareness raising and ensuring future availability of ngitili products. An interesting perspective is offered by Brockington [59], who argues that strong transparent governance is not necessarily a prerequisite for successful natural resource management but that adverse situations of weak and corrupt governance can stimulate collective action to ensure sustained management. The chasing out of VEOs in village B serves as a similar case where corrupt practices of leaders incited vigilance and demands for accountability among the community.

#### *4.2. Existing Management System and Characteristics of Adaptive Capacity*

The dynamic nature of landscapes, actor demands and climate change ask for resiliency and adaptive capacity from the natural resource management system [77,84,86,87]. Ngitili management has evolved to cope with changes in the biophysical, economic and socio-political environment: in some cases from communally managed to privately managed, from protected area to open use area and back to protection again and the ngitili concept itself has changed from grazing to forest reserve. Hence, the ngitili management arrangements show signs of adaptive management but in many characteristics they fall short on adaptive capacity (see adaptive capacity [88,89]). The management is based on multiple actors and local community members and assembly are engaged in communal ngitili decision-making, patrolling and benefit sharing enabling social learning and use of local and experiential knowledge, all of which are part of adaptive management [81,88,90,91]. However, learning is constrained by lack of education, resources to experiment as well as limited stakeholder representation and multi-sector collaboration, which would enable shared understanding for actions and objectives. In the intervention villages, the interventions have offered opportunities to build forums for sharing through vertical and horizontal linkages but they have failed or not even sought to establish permanent multi-actor collaboration structures, which bridge organizational levels and sectors. Hence, there is a need for bridging organizations making the existing community-based management system to benefit from the multi-sector engagement and policy support.

The short-term nature of multi-actor interventions and lack of human and financial resources undermine adaptive capacity and sustainability of the ngitili management. Trust building between actors often requires long time [92] and institutional arrangements may run into the risk of collapse of vertical linkages or established bridging organizations without continued funding [2,21] as is the case in the two intervention villages of this study. Availability of human and financial resources including incentives to reward efforts and compensate loss of opportunities has been identified as among the most crucial success factors in landscape governance [2,84,93]. Furthermore, in a study of 87 integrated landscape initiatives in Africa improvements made in capacity building, bridging organizations and wider stakeholder participation were associated with greater positive outcomes towards landscape management [1]. The study suggests that strides made in enhancing multi-actor adaptive governance systems pay off in landscape resiliency. Similar study of 104 initiatives in Latin America does not find the same association between institutional development and landscape resilience but instead highlights that the development of governance system and

tangible improvements to the landscape management might need longer time and long term support [94]. Our study suggests that development towards resilient landscape management can be steered by careful investigation of the existing institutional arrangements, which might already exhibit characteristics of adaptive management but that sustained funding sources for the local management actors and bridging organizations are needed.

## 5. Conclusions

Our study on the institutional arrangement and relationships in traditional community-based rangeland management system in Tanzania's semiarid north-western region shows the importance of distilling the complex elements of resilience and sustainability in a particular socioecological system. While the communal management of ngitilis might not always be able to secure the ngitilis intact or their importance has not always been recognized in the community, the ngitilis have sustained and continue to be valued when the management is mobilized locally. The ngitili management is based on locally negotiated roles and collaboration among bureaucratic and socially embedded village level institutional actors. The institutional arrangements have evolved with time and national policies and interventions have introduced new management actors while environmental degradation and demand for resources have increased the need for environmental management. At present, the institutional actors are in need of diversified funding sources, technical support and benefit sharing mechanisms to allow and incentivize sustainable resource management. Furthermore, influential actors and community at large require capacity building as well as awareness raising on environmental protection and decision-making processes which enable wider stakeholder participation.

Finally, the study shows that the short-term nature of multi-actor interventions and lack of human and financial resources undermine adaptive capacity and resilience of the communal ngitili management. Ensuring the resilience and sustainability of the community-based natural resource management under increasing pressure on these resources and climate change requires careful investigation of the existing management arrangements, which might already have characteristics of adaptive management but which require bridging organizations for multi-sector engagement, learning, and adaptive capacity. Our empirical case supports the calls for recognizing the existing, often varied institutional arrangements, their limitations and wider economic and political linkages in order to achieve the goals of landscape restoration efforts, such as the Bonn challenge and UN Decade on Ecosystem Restoration, and ultimately landscape resilience [41,95,96].

## 6. Endnotes

1. Resettlement of people into designated villages and collectivization of means of production based on the development plan, the Arusha Declaration of 1967 in Tanzania.
2. The studied villages have traditional collaboration networks, which are for mutual help and reciprocity in the community, some of which are ngitili related. These for example function in alerting on ngitili violators. There are also traditional beliefs, such as sacred animals not to be disturbed in ngitilis, and traditional unwritten punishments, such as ostracism, which increase obedience to the formal regulations. Furthermore, it seems that a tradition of ability to ask permission to use the ngitili resources from the ngitili owner has existed for a long time in the villages.

**Supplementary Materials:** The following are available online at <https://www.mdpi.com/article/10.3390/su131910939/s1>, Table S1: List of institutional actors, their characteristics, 4Rs and notes on differences between the intervention and non-intervention villages. Table S2: Social network analysis scores.

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