ARE TRADITIONAL INSTITUTIONS EFFECTIVE IN REGULATING FOREST USE AND SUSTAINING FOREST RESOURCES? EXPERIENCE FROM NYUMBA-NITU, SOUTHERN HIGHLANDS, TANZANIA

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ABSTRACT

Tanzania is among countries challenged by deforestation. Policies responsible for management of forests in the country have changed since pre-independence to-date mainly to address deforestation. The National Forest Policy of 1998 and Forest Act Cap 323 [R.E. 2002] both promote participatory forest management through which traditional institutions are officially recognized. This study investigated the effectiveness of traditional institutions in forest management. The study used Nyumba-Nitu Traditional Forest Reserve (NTFR) as a case study and monitored tree and shrub species diversity and stand stocking. Generally, results reveal that traditional institutions are accepted and receive high respect by public at local level. This is because traditional institutional frameworks take care interest of local people. Access and user rights to NTFR are granted by ritual leaders. The study found that forest stocking was not statistically different between surveys carried out in 2002 and 2009. Similarly, results on forest stocking depict an inverse J-shaped curve (size class distribution) which is a sign of stable stand characterized by regeneration and active recruitment of trees and shrubs. This is due to regulated access and forest use. The study concludes that traditional institutions are effective in controlling forest use and sustaining forest resources.

Key words: Nyumba-Nitu - traditional institutions – forest use - forest stocking - species diversity

INTRODUCTION

Tanzania has about 35.3 hectares of forests and woodlands (FAO 2006). Forests and woodlands offer environmental service and are source of timber, fuel wood and non-wood forest products which are essential for livelihoods. Like many countries in the tropics, Tanzania is challenged by high rate of deforestation ranked after Brazil, Indonesia, Mynmar and Zambia (Toulmin 2009). The rate of deforestation in Tanzania is estimated at 420,000 hectares per annum (FAO 2006). Deforestation may have impact on forest stand structure in terms of stocking and species diversity which have implication on livelihoods of forest dependent communities. Underlying factors for environmental destruction fall under one or a combination of four categories: (i) market failures (externalities), (ii) government failures (environmentally adverse policies), (iii) population growth and (iv) property rights failures (Heltberg 2002).

In Tanzania, the 1990s saw a wave of policy and governance changes in natural resource sectors addressing the problems created by the colonial legacy of centralised forest management approach. This move resulted into a new National Forest Policy of 1998 and Forest Act Cap 323 [R.E. [2002] which promote

Participatory Forest Management (PFM). PFM entails two approaches popularly known as Joint Forest Management (JFM) and Community Based Forest Management (CBFM). Traditional forests fall under CBFM.

Studies show that villagers in Tanzania and elsewhere in Africa and beyond have traditionally "reserved" forests for a range of purposes such as productive, social, traditional or sacred (Anyinam,1999; Ylhäisi 2004; Ylhäisi 2006; Chun 2009; Kibet 2011). According to Kajembe *et al.* (2002, 2003), several traditional institutions exist in many places in Tanzania and play different roles in the management of natural resources. Examples include the "*ngitili*" forests (traditional dry season fodder reserves) in Shinyanga and Mwanza regions, Tanzania and the "*mpungi*" or "*mshitu*" clan forests of North Pare Mountains, Tanzania used for sacred reasons to name just a few (Kaale *et al*. 2002; Mwihomeki *et al*. 1998). Explaining the role of traditional institutions, Mwihomeke *et al.* (2000) asserted that in terms of plant diversity, a large proportion of species found in traditionally protected forests is not comparable to that in the surrounding non-protected areas. The authors further argued that many of the remaining patches of evergreen forests and woodlands worldwide are traditionally protected. These examples clearly illustrate the role of traditional institutions in sustaining natural resources. It is therefore important to understand the effectiveness of traditional institutions in forest management. However, existing information in this area remain inadequate (Anyinam 1999; Mwihomeke *et al.* 2000; Ylhäisi 2004; Ylhäisi 2006).

The aim of this study was to assess the effectiveness of traditional institutions in forest management taking Nyumba-Nitu Traditional Forest Reserve (NTFR) as a case study. Effectiveness here refers to the capability to achieve desired results. The study used forest use rules enforcement, tree and shrub species diversity and forest stocking as measures of effectiveness of traditional institutions in forest management. In this this study, institutions are conceptualised as set of rules, norms, habits and formal hierarchies that shape agents' actions and expectations (North 1989, 1991).

MATERIALS AND METHODS

Description of the study area

NTFR a traditional forest reserve located in Mlevela village, Mdandu division, Njombe district, Iringa region. Mlevela village is located south – east of Njombe town, about 15 km from Njombe town. The village includes five hamlets including Ushirika, Nywage, Uchiliwara, kibegogoni and Idunda. According to village government officials, the traditional forest reserve is about 1.5 ha. Njombe is located between 9° 15´ S and 35° 0´ E. The population of the Njombe District was 420,348 according to the 2002 Tanzania National Census statistics reference?. The main economic activities in Njombe district are agriculture and forestry. The District is one of the largest producers of irish potatoes and maize while beans is grown to a small extent. The District also grows trees for timber and electric poles.. The main tree species grown in the area is Pine while Eucalypts and Cypress make the minority. Dar es Salaam is the largest market for timber followed by local market where timber is sold for carpentry, building and construction activities.

Methods

Data collection

Socio-economic data

Socio-economic data were collected through Participatory Rural Appraisal (PRA), focus group discussion, and household interviews which aimed to explore traditional institutions responsible for management of NTFR, forest use rules and enforcement. The use of various methodological approaches in in collecting similar data aimed to triangulate and validate data.

PRA was conducted at Mlevele village office, an exercise which included young, middle-aged and elders. Both men and women were represented in the exercise. Resource mapping, historical time lines and venn-diagram are PRA tools used in this study. Resource mapping aimed at exploring resource types available in the study area and how they are used while historical time lines aimed at identifying key positive and negative events and trends.. Accordingly, venn-diagraming intended to reveal interaction between traditional institutions and other institutions. Besides, focus group discussion was administered to key informants, information captured include existing traditional institutions, management structure, forest use rules, enforcement and reasons for protecting the NTFR. A total of 54 households were randomly sampled in the study area for a structured questionnaire administration. This is equivalent to 6.5% sampling intensity. Questions explored people's awareness and recognition of traditional institutions, forest use rules and enforcement.

Ecological data For the purpose of assessing the effectiveness of traditional institutions in forest management, two data sets on tree and shrub species diversity and forest stocking were studied. The first data set was collected in 2002 by International Forest Resources and Institutions Collaborating Research Center abbreviated as IFRI-CRC-TZ while the second data set was collected in 2009.. Both data sets were collected through forest inventory techniques. Forest inventory was carried out according to IFRI (2004) protocol in which a total of 30 circular plots (with a maximum radius of 10m) were systematically laid in the entire forest. The inventory aimed at assessing species composition, diversity and forest stocking (stem density, basal area and volume per hectare). In each plot, the following information were recorded:

- ❖ Within 1m radius: All woody regenerants of less than 2.5 cm Dbh were recorded.
- ❖ Within 3m radius: All woody trees and shrubs with Dbh greater than 2.5cm but less than 10cm were identified, measured and recorded for Dbh and height.
- ❖ Within 10m radius: Large trees with Dbh greater or equal to 10cm were identified, measured and recorded for Dbh and height.

In each sampling unit, indicators of disturbances such as grazing, cuts (stumps), slash and fire were recorded.

Data analysis

Socio-economic data

Qualitative data were subjected to content and structural-functional analyses. Prior to content and structural analyses, the data were analysed with the help of the local communities while quantitative data were analysed by using Statistical Package for Social Sciences (SPSS version 15.0).

Ecological data

Analysis of ecological data involved computation of Shannon-Weiner species diversity index (Equation 1) and stocking parameters (stem density (N) (Equation 2), basal area (G) (Equation 3) and standing volume (V) (Equation 4)). Microsoft excel spread sheet package was used in the analysis. For the purpose of analysis and presentation of data, five diameter (Dbh) classes (1 – 10, 10.1 – 20, 20.1 – 30, 30.1 – 40, > 40.1 cm) were used. Computation of various parameters are detailed hereunder:

(i) Species diversity (H')

$$H' = -\sum_{i=1}^{s} P_i \ln P_i \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Source: Kent and Coker (1992)

Where; H' = the Shannon index of diversity, ∑ = the summation symbol, s = the number of species, p_i = the proportion of individuals or the abundance of species i in the sample, ln = the logarithm to base e and - = the negative sign multiplied with the rest of variables in order to make H' Positive.

(ii) Stem density (N) (Stem counts/ha)

$$N = \frac{i}{A} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where; N = Stem density (stem count/ha), i = Stem count and A = Plot area (ha)

(iii) Basal area (G) (m^2/ha)

$$G_i = \frac{\pi dbh^2}{4} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where; dbh = Diameter at breast height (cm), Π = Pie, and G_i = Basal area of a tree/shrub (m^2).

(iv) Volume (V) (m^3/ha)

$$V = 0.5 * g_i * h_i \quad \ldots\ldots\ldots\ldots\ldots\ldots (iv)$$

Where; h_i = Tree/shrub height (m).

Furthermore, *t-test* was performed to compare species diversity and stocking parameters between 2002 and 2009.

RESULTS

Traditional institutions and their role in management of NTFR

History of NTFR

Ancestors affiliated to Nyumba-Nitu started from Mbena to Tevele, Mkilaugi, Mponda, Malova, Ngiliviga, Chalula, Kahemele and Mhimba. Nyumba-Nitu means '*Nyumba nyeusi*' i.e 'Black house' is believed to have been inhabited by Mbena. The importance of Nyumba-Nitu started as a burial place for early ancestors (Mbena and others). Later on, clan after clan started to use the place for performing traditional rituals in the belief that their ancestors could help them in terms of fortunes and in solving their problems and at times avert oncoming calamities (IFRI, 2002). Before colonial era, the area surrounding the forest was under Chief Mbeyela who later sold it to the Tanganyika Wattle Company (TANWAT) in 1949 with an agreement that the forest should not be destroyed. Until to-date the forest is under TANWAT lease (IFRI, 2002). It is narrated that when TANWAT acquired the forest, they planned to clear it in order to plant *Acacia mearnsii* a key species for the company planted in the surrounding landscape. It is claimed that however, the plan did not succeed as every time they cleared the forest they found it intact the subsequent day. Following this "miracle", the TANWAT management decided to leave the forest intact and handed it over to the village government. Institutionally, therefore the forest is under common property regime while TANWAT plantations surrounding the reserve are under private property regime (IFRI, 2002).

Institutional setup in the management of NTFR

Despite NTFR being under Mlevela village government, it is managed by ritual leaders.There are three ritual leaders who represents three clans namely Fute, Kiswaga and Mkongwa. The three brothers are descendants of Kahemele. Each of the three ritual leaders has a separate responsibility with regard to NTFR. Fute's responsibility is to feed people during hunger, Kiswaga is responsible for ritual services while Mkongwa's responsibilities entail safeguarding the forest. The ritual leaders, village government and District Forest Office are in good terms and share responsibilities in the management of the forest. The ritual leaders meet once annually to discuss matters pertaining the forest.

Traditional activities inside the NTFR

During focused group discussion, ritual leaders argued that NTFR is protected for three main purposes: (i) ritual activities (prayers, blessings and thanksgiving), (ii) sustain tradition and customs and (iii) source of medicine and healing. Plate 1 shows the ritual site inside the forest. Ritual activities are performed in a specific place and tree, ritual leaders enter the ritual site dressed in black and bare footed. Silence is an important norm observed once inside the forest. Rituals are performed before or after an important event.

For example, before new year ritual to thank the ancestors for all the blessing during the year and ask for blessings and guidance during the forthcoming year) is performed while after an important event such as disaster, a ritual is performed in order to gain courage and strength in confronting the disaster. Results from household survey indicate that 98% recognize sacredness of the forest and are faithful to rules and regulations about NTFR.

Forest use, rules and enforcement

NTFR has for long been used to support traditional livelihoods since ritual activities are required for a living such as ritual activities as well as a source of medicinal plants. Appendix 1 summarises various uses of tree and shrub species found in the forest where nearly all species are medicinal. Khumbongmayum *et al.* (2004) in India asserted that rural poor depend upon biological resources to satisfy 90% of their day-to-day needs. Tropical forests provide medicine for around 3 million people in the world (Bodjrenou 2006). The forests form a kind of botanical garden where the traditional healers can find rare medicinal plants, often essential for their pharmacopoeia (Mgumia and Oba 2003). It is further argued that sacred forests shelter altars, cemeteries, and museums of the community history. They are a place of communion with the Gods and sanctuary for initiations (Mndeme 1997; Juhé-Beaulaton and Roussel 2003). Recently, the forest reserve has gained fame and is attracting visitors from around and beyond Njombe District.

Entrance to the forest reserve is guided by rules and regulations enacted by ritual leaders. Rules and regulations include no entry without permission, no collection of any material from the forest reserve without permission and entry fee for visitors. Entrance fee for visitors and researchers is TZS 50,000/= (USD 32.3), out this TZS 30,000/= (USD 19.4) goes to ritual leaders and the rest goes to the village government for funding various development activities. Anyone who violates rules and regulations is fined. Fines include black hen, black sheep, black cow and black clothes. During focused group discussion ritual leaders stressed that, prayers; thanksgiving and collection of medicine are allowed with permission. However, things not allowed include debarking, cutting down trees and taking excessively large amount of medicine. Restrictive use forest resources in NTFR are perceived positively by villagers. This is deduced from positive response of all surveyed households who commented that if destructive use was allowed the forest wouldn't have existed to-date. The study further revealed that rules and regulations are respected and adhered to by nearly all members of the community. This was supported by 98% of surveyed households.

Dynamics of tree and shrub species diversity and stocking in NTFR

Tree and shrub species diversity and stocking were studied in thirty plots in 2002 and 2009 following IFRI 2004 protocol to assess change over time. Tree and shrub species diversity and stocking served as surrogate measure for effectiveness of traditional management of NTFR.

Tree and shrub species composition and richness in NTFR

A total of 31 tree and shrub species were measured both in 2002 and 2009 (Appendix 1). Dominant species in a survey undertaken in 2002 were *Teclea nobilis* (34%), *Rhus natalensis* (13%), *Albizia schimperiana* (9%), *Lausonia lucida* (9%) and *Ekergea capensis* among others while during 2009, *Teclea nobilis* (20%), *Mystozylon aethiopicum* (12%), *Albizia schimperiana* (9%), *Vangueria infaustica* (9%) and *Rhus natalensis* (7%) were dominant. Despite the slight difference in species distribution particularly among dominant ones in the forest reserve between the two surveys, the study reveals no change in species composition between the successive surveys. In other words tree and shrub species are sustained. The plausible reason for change in species distribution could be recruitment, aging and natural death of trees and shrubs over time. PRA revealed that about 70% of tree and shrub species found in NTFR are not found elsewhere within the village though it is likely that similar species may be found beyond the village. Accordingly participant observation revealed that, most land is either planted with exotics or used as farmland. The main landuse in the surrounding landscape is forest plantation followed by farming. *Acacia mearnsii* and *Pinus patula* are among the prominent exotic species in the area. Kokou (2006) argued that most rare species are exclusively found in sacred forests. For example, in North-Eastern India, 133 species of native plants are found only in several sacred groves (Byers *et al.* 2001). Such species are highly vulnerable and would probably disappear with the destruction of the sacred groves. NTFR is both traditional and sacred; it is sacred because among others it is venerated or considered a holy place while it is traditional when it entails customs passed from one generation to another.

Shannon-Wiener Index (H') of tree and shrub species diversity in NTFR

The study revealed a Shannon-Wiener Index of species diversity of 2.802 for th forest while results from a previous survey shows H' of 2.344 (Table 1 and Appendices 2 and 3). However, results between the two surveys were not statistically different (Table 1). Shannon-Wiener Index of species diversity tells about species richness (number of species) and evenness (species distribution) (Magurran, 1988). The greater the value of H' the greater the species diversity in the scale of 0.0 to 5.0. Barbour *et al*. (1999) further argued that an ecosystem with H' value > 2 is regarded as medium to high diverse in term of species. Thus, NTFR has reasonably high diversityin terms of species across time.

Stocking of standing crop in NTFR

The overall mean stem density in N TFR was found to be 1159±286 (SE) stems/ha (Table 1). These results were not statistically different when compared to results of a previous survey conducted in 2002 (Table 1). Results show an inverted 'J' shaped curvewhich is common for natural forests with active regeneration and recruitment (Phillip 1983).

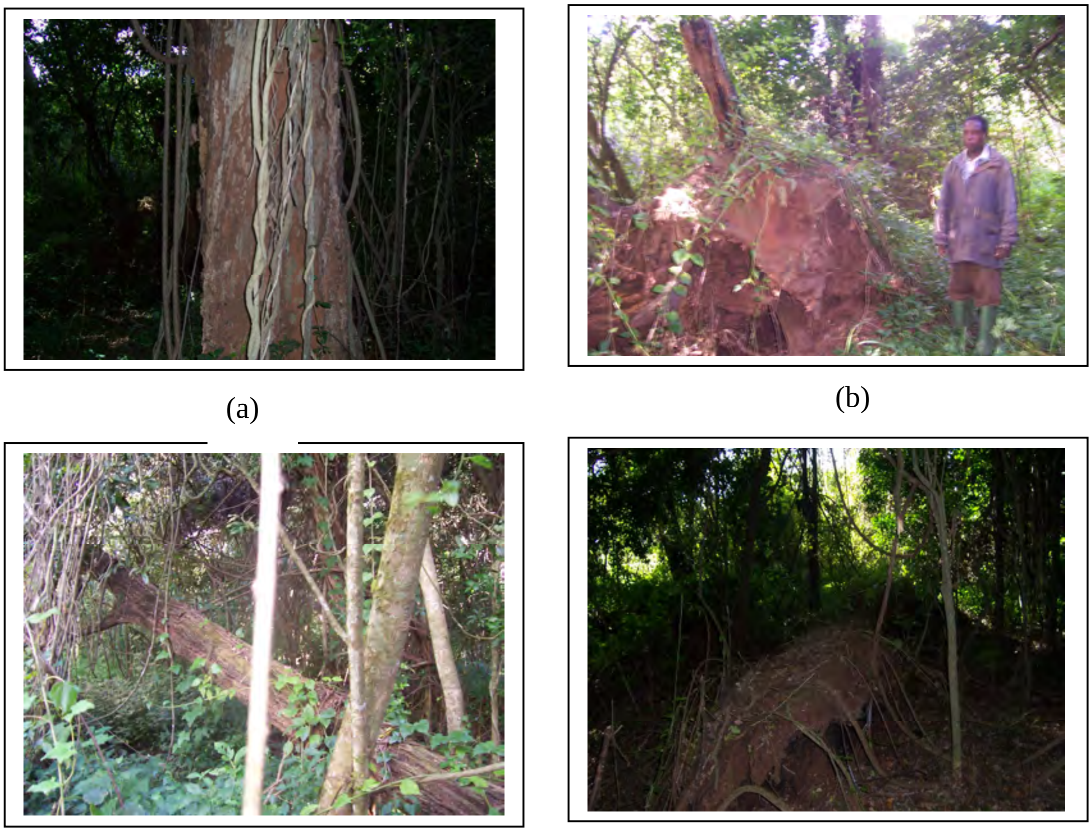
The study found mean basal area and volume of 18±5.01 (SE) m^2/ha and 113.45±36.38 m^3/ha (SE) respectively in NTFR. There was no statsical significant difference between results in this study and those of the previous survey (Table 1). The slight statistical difference exhibited by these results indicates appreciation of the TFR in terms of basal area and volume of standing crop. These good results may be attributed to the role played by traditional institutions in effectively managing and hence sustaining the forest TFR. This is particularly observed by increase in stand basal area and volume over time. *Croton macrostachyus*, *Nuxia congesta*, *Albizia schimperiana*, *Zyzgium guineese*, *Mystozylon aethiopicum*, *Teclea nobilis* and *Rhothmannia fischeri* are tree and shrub species found to have greater contribution to the overall standing volume in the forest. Similar results were observed in previous survey.

Table 1: Comparative analyses of species diversity and stocking parameters

			Statistical test	
Stocking parameters	2002	2009	T-value	P-value
Stem density (N) (# of stems/ha)	1111±220 (SE)	1159±286 (SE)	1.6715	0.8994**
Basal area (G) (m^2/ha)	13.10±2.49 (SE)	18±5.01 (SE)	1.6772	0.3840**
Volume (V) (m^3/ha)	100.87±24.93 (SE)	113.45±36.38 (SE)	1.6725	0.7993**
Species diversity (H')	2.344±0.017 (SE)	2.802±0.014 (SE)	1.6772	0.9626**

*significant at 5% level (P < 0.05); **Not significant at 5% level (P < 0.05)

A comparative analysis presented in Table 1 clearly shows that forest resources in NTFR have not changed in terms of tree and shrub species diversity and stocking over time. This was supported by 94% of surveyed households. Respondents claimed that the forest has not been degraded over time. Plate 2 (a, b, c and d) further support and indicate how effectively the TFR is conserved.



(a) (b) (c) (d)

Plate 2 (a, b, c and d): Forest condition inside Nyumba-Nitu TFR

Not a single stump, slash, grazing or signs of fire were recorded during forest inventory. Such observations suggest that the forest reserve is not degraded.

DISCUSSION

Legitimacy of traditional institutions and forest management

Generally, results of this study reveal that traditional institutions are accepted and receive high respect by public at local level. 98% of surveyed households claimed that they adhere to rules and regulations pertaining management of NTFR. The surveyed households consisted of men and women, young, middle aged and old men. Based on this we are confident to predict that, traditional institutions and the Nyumba-Nitu TFR are likely to sustain even for a far future to come as fidelity of rules and regulations will be passed from one generation to another. Furthermore, once the Nyumba-Nitu forest was given to the village government, the village government itself entrusted the day to day management of the forest reserve under the leadership of ritual leaders. In other words, such a process meant to institutionalise traditional institutions. Acceptability of traditional institutions is plausibly rooted in the fact that the entire framework of the institutions is in the interest of local settings which include prayers during hunger, blessings for good lucky and thanksgiving. All such undertakings are linked to belief which in essence is a personal matter yet has societal impact. This has to a great deal served as a vehicle in sustaining the forest. Some scholars (Wadley and Colfer 2004) have made a close link between sacred forests and biodiversity conservation and argue that the religious value attached to the forests is a way to allow their successful conservation. Sacredness of some forests force local communities to harvest natural resources in an ecologically sustained way (Chandrakanth *et al.* 2004). This is a typical case in NTFR where traditional institutions together with the surrounding society have collectively managed the forest sustainably.

Forest condition

Appendix 1 summarizes use of tree and shrub species which include timber, pole, firewood, carvings among others. Factors dictating these uses are either domestic or market demand forces. However, no any sign of degradation was noticed in the NTFR despite domestic or market demand forces. This suggests that traditional institutions have power to shape peoples' behaviour. Access and user rights to the NTFR are granted by ritual leaders who explicitly define what is allowed and what is not allowed. During focused group discussion indicated that, no destructive use of the forest is allowed and that communities have been very instrumental in keeping this norm. Plate 2 shows thatthe FR is in good condition and natural ecosystem processes e.g. regeneration take place smoothly. This has sustained the forest and plausibly contributed to high level of consistency in tree and shrub species diversity and stocking over time. Similarly, the observed J shaped curve in basal area and volume data between the two surveys suggests that trees and shrubs in the forest are growing to their optimal size without adverse condition due to effective forest management. Other studies have commended that traditional forests as high potential for achieving sustainability of forest resources because people enter in such forests for permitted purposes only Ylhäisi (2000). Sustainable management of NTFR attracts visitors who pay entrance fees to the relevant authority. This is vital particularly for local economy and wellbeing the people.

The inverse exponential function of standing trees and shrubs which follows the inverse J shaped curve as depicted in Figure 1 (a) and 1 (b) suggests that the forest stand is stable due to active regeneration and recruitment of tree and shrub species in space and time. Figure 1 (c) however shows a more smooth curve for 2009 data compared to 2002 data., It may be deduced that stability of the forest stand improves over time through improved regeneration and recruitment. This may be attributed to the effectiveness of traditional management systems.

CONCLUSIONS AND RECOMMENDATION

The study concludes that traditional institutions have demonstrated effective forest management. The forest was in danger of disappearing when sold to TANWAT. However, "miracles" attached to traditional institutions came to the rescue of the forest. Traditional institutions have remained resilient due to their legacy and recognition at local level is seen by the prevailing institutional interplay between administrative units/organs both horizontally (Ritual leaders and village government) and vertically (Ritual leaders and District Forestry Office). If rules and regulations were not restrictive and respected, people would have used the forest unsustainably. This would have altered stand stability hence leading to degradation and disappearance of some species. Based on results of this study, it is recommend that in order for CBFM to be successful, local people should have the right to self-determination and decision making over the forests under this management regime.

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REFERENCES

Anyinam, C., 1999. Ethno-medicine, sacred spaces, and ecosystem preservation and conservation in Africa. In Kalipeni E. and P. T. Zeleza (eds.). *Sacred spaces and public quarrels: African cultural and economic landscapes.* Pp. 127 - 146. African World Press.

Byers, B. A., Cunliffe, R. N., and Hudak, A. T., 2001. Linking the conservation of culture and nature: A case study of sacred forests in Zimbabwe. Human Ecology, Vol 29(2): 187 - 218.

Chandrakanth, M.G., Mahadev, G., Bhat and Accavva, M.S., 2004. Socio-economic changes and sacred groves in South India: Protecting a community-based resource management institution. Natural Resources Forum 28: 102 - 111.

Chun, Y. W., 2009. Songgye, a traditional knowledge system for sustainable forest management in Choson Dynasty of Korea. *Forest Ecology and Management* 257: 2022 –2026.

FAO 2006. Global forest resources assessment 2005: progress towards sustainable forest management. Food and Agriculture Organization of the United Nations, Rome, 2006. http://www.fao.org/forestry/fra/fra2005/en/

Heltberg, R., 2002. Property rights and Natural resource management in developing countries. Journal of Economic Survey 16 (2): 189 – 214.

IFRI (International Forest Resources and Institutions Collaborating Research Centre) 2004. IFRI Program Field Manual Version 10.5, produced by the Centre for the study of Institutions, Populations and Environmental Change.

IFRI (International Forest Resources and Institutions Collaborating Research Centre) 2002. About the Nyumba-Nitu traditional forest and the cave: IFRI Outreach Series No. 1.

Juhé-Beaulaton, D., and Roussel, B. 2003. Part I: Sacred Spaces in Ritual Practices, May Vodun Sacred Spaces be considered as a Natural Patrimony? In Göttinger Beiträge Zur Asienforschung Heft 2-3, Creating and Representing Sacred Spaces, by Gardner and Moritz. Germany, pp 2 - 19.

Kaale, B., Mlenge, W., and Barrow. E., 2002. The Potential of Ngitili for Forest Landscape Restoration in Shinyanga Region - A Tanzania Case Study. International Expert Meeting on Forest Landscape Restoration, Costa Rica. 25 p.

Kajembe, G. C., Mwaipopo, C. S., Mvena, Z. S. K., and Monela, G. C., 2002. The role of traditional institutions, leadership and ecological knowledge in sustainable management of miombo woodlands in Handeni district, Tanzania (unpublished).

Kajembe, G.C., Luoga, E.J., Kijazi, M.S., and Mwaipopo, C.S., 2003. The role of traditional institutions in the conservation of forest resources in East Usambara, Tanzania. *International Journal of sustainable World Ecology*, 10:101 - 107.

Kent, M., and Coker, P., 1992. *Vegetation Description and Analysis, A practical Approach*. Belhaven Press, 25 Floral Street, London. 363 pp.

Khumbongmayum, A. D., Khan M. L., and Tripathi, R. S., 2004. Sacred groves of Manipur – ideal centres for biodiversity conservation. Current Science 87: 430 - 432.

Kibet, K., 2011. Plant communities, species diversity, richness, and regeneration of a traditionally managed coastal forest, Kenya. *Forest Ecology and Management* 261: 949 – 957.

Kokou, K., 2006. Forêts sacrées, conservation de la biodiversité et développement durable: la situation au Togo. Le Flamboyant, bulletin de liaison des membres du Réseau International Arbres Tropicaux, n°61, pp 22-26.

Magurran, E.A., 1988. *Ecological Diversity and its Measurement*. Princeston University Press, Princeston. 179 pp.

Mgumia, F.H., and Oba, G., 2003. Potential role of sacred groves in biodiversity conservation in Tanzania. Environmental Conservation 30 (3): 259 - 265.

Mndeme, K. C., 1997. The effect of loss of indigenous knowledge on the protection and Management of Mpungi, Mshitu and local forest in North Pare Mountains. Presented at an international conference on Future of Eastern Arc Mountains, Morogoro, Tanzania.

Mwihomeke, S., Msangi, T., Mabula, C., Ylhäisi, J., and Mndeme., K.C.H., 1998. Traditionally protected forests and nature conservation in the North Pare Mountains and Handeni Distirct, Tanzania. *Journal of East African Natural History* 87, 279 – 290.

Mwihomeke, S., Mabula, C., and Nummelin, M., 2000. Plant species richness in the traditionally protected forests of the Zigua, Handeni District, Tanzania. *Silva Carelica* 34: 178 - 193. Joensuu, Finland.

North, D.C., 1989. Institutions and Economic Growth: An historical introduction. World Development 17, 9: 19 – 32.

North, D., 1991. Institutions. Journal of Economic Perspectives 5 (1): 97 – 112.

Okafor, J.C., and. Ladipo. D.O., 1992. Fetish groves in the conservation of threatened flora in southern Nigeria. pp 167 – 179 in Bennun, L.A., R.A. Aman and S.A. Crafter (eds.): *Conservation of biodiversity in Africa. Local initiatives and institutional roles*. Centre for Biodiversity, National Museums of Kenya, Nairobi.

Philip, S. M., 1983. *Measuring Trees and Forests*. Division of Forestry, University of Dar es Salaam, Tanzania. Aberdeen University Press, Great Britain. 337 pp.

Sigu, G.O., Omenda, T.O., Ongugo, P.O., and Opiyo, A., 2004. *Sacred Groves Institutions, Rule Enforcement and Impact on Forest Condition: the case of Ramogi Hill Forest Reserve, Kenya*. Kenya Forestry Research Institute – IFRI [http://www.biodiv.org/doc/case-studies/for/cs-ecofor-ke-01-en.pdf.]. Visited on April 21, 2005.

Toulmin, C., 2009. Social and political drivers of land use change, deforestation and degradation. Paper presented at the seminar: Poverty, Forests and Climate Change – Practical Strategies for Ensuring Pro-Poor Approaches to REDD. DIIS, Copenhagen, April 21st 2009.

Uphoff, N., 1986. Local institutional development: An analytical source book with cases. Kumarian Press, Hartfold.

URT (United Republic of Tanzania) 1998. The National Forest Policy. Ministry of Natural Resources and Tourism, Forest and Beekeeping Division, Government Press, Dar es salaam, Tanzania. Dar es Salaam, Tanzania. 69 pp.

Wadley, R.L., and Colfer, C. J., 2004. Sacred Forest, Hunting, and Conservation in West Kalimantan, Indonesia. Human Ecology, Vol. 32, No. 3. pp 313-338.

Ylhäisi, J., 2000. Th e signifi cance of the traditional forests and rituals in Tanzania: A case study of the Zigua, Gweno and Nyamwezi ethnic groups. *Silva Carelica* 34: 194 - 219.

Ylhäisi, J., 2004. Indigenous forest fragmentation and the signifi cance of ethnic forests for conservation in the North Pare, Eastern Arc Mountains, Tanzania. *Fennia* 182: 109 - 132. Helsinki, Finland.

Ylhäisi, J., 2006. Traditional Protected Forests and Sacred Forests of Zigua and Gweno Ethnic Groups in Tanzania. PhD thesis, Department of Geography, University of Helsinki, Finland.

APPENDICES

Appendix 1: Master tree and shrub species checklist for Nyumba-Nitu Traditional Forest Reserve (TFR)

SN	Spp code	BOTANICAL NAME	LOCAL NAME	FAMILY NAME	HABITAT (T = Tree and S = Shrub)	USE (S)
1.0	4	*Albizia schimperiana*	Mtembelele/Lifunda	Fabaceae	T	Timber
2.0	6	*Apodytes dimidiata*	Mlufila	Icacinaceae	T	Firewood, Pole
3.0	1	*Bersama abyssinica*	Mbasamono	Melianthaceae	T	Timber
4.0	14	*Cassipourea malosana*	Lihapi	Rhizophoraceae	T	Timber, Medicine
5.0	19	*Celtis africana*	-	Ulmaceae	T	Firewood, Pole, Medicine
6.0	20	*Clausea anisata*	-	Rutaceae	T/S	Firewood, Pole, Medicine
7.0	2	*Croton macrostachyus*	Libadrula/Livulugu	Euphorbiaceae	T	Firewood, Pole, Medicine, Timber
8.0	3	*Diospyrus whyteana*	Nyamituti	Ebenaceae	T	Firewood, Pole
9.0	7	*Dombeya sp.*	Mkeyu	Steculiaceae	S	Firewood, Pole
10.0	8	*Ekerbegia capensis*	-	Meliaceae	T	Timber, Medicine
11.0	9	*Erythrococca kirkii*	-	Euphorbiaceae	T	Timber, Medicine
12.0	10	*Euclea natalensis*	Mkala/Likala	Ebenaceae	T/S	Firewood, Pole, Timber
13.0	30	*Ficus sp.*	Mtsombe	Moraceae	T	Shade
14.0	11	*Lausonia lucida*	-	Flacourtiaceae	T	Firewood, Pole, Medicine
15.0	12	*Lepidotrichilia volkensii*	-	Meliaceae	T	Firewood, Pole, Medicine
16.0	13	*Lipiana javanica*	Luhongole	Verbenaceae	S	Firewood, Medicine
17.0	5	*Maytenus senegalensis*	Mwifwa	Celastraceae	S	Firewood, Medicine
18.0	21	*Mystozylon aethiopicum*	Mhezela/Ihezela	Celastraceae	T	Firewood, Pole, Wooden spoon, Timber, Medicine, Motor and Pestle
19.0	22	*Nuxia congesta*	Mgongoti	Loganiaceae	T	Timber, Medicine
20.0	23	*Ochna holstii*	Linyahiganga	Ochnaceae	T	Firewood, Pole
21.0	15	*Olea africana*	Mgiwe	Oleaceae	T	Firewood, Pole
22.0	16	*Prunus africana*	Muhedrela	Rosaceae	T	Timber, Food
23.0	17	*Psychondria mahonii*	Mkomangholo	Rubiaceae	T	Firewood
24.0	31	Rhoicissus tridentata	Likungulu	Vitaceae	T	Rope, Water from stem
25.0	24	*Rhothmannia fischeri*	Dongadonga	Rubiaceae	T	Firewood, Pole, Snuff container, Medicine
26.0	25	*Rhus natalensis*	-	Anacardiaceae	S	Timber, Food, Tool handle, Medicine
27.0	18	*Schrebera alata*	Mkombalwiko	Oleaceae	T	Tool handle, Wooden spoon
28.0	26	*Syzgium guineense*	Mvengi	Myrtaceae	T	Firewood, Pole, Edible fruit
29.0	28	*Teclea nobilis*	Mpimbimbiti/Lipimbiti	Rutaceae	T	Medicine
30.0	29	*Tecomaria capense*	Liholozi/Linyunyi	Bignoniaceae	S	Firewood, Ornamental carvings
31.0	27	*Vangueria infausta*	Lisada/Msada	Rubiaceae	T/S	Edible fruit, Medicine

Appendix 2: Distribution of N, G and V by species and diameter classes and Shannon-Wiener (H') species diversity indices of standing crop in Nyumba-Nitu TFR (2002)

		BDH classes (cm)																		
		I			II			III			IV			V						
Spp		1 - 10			10.1 - 20			20.1 - 30			30.1 - 40			> 40.1			Total			H'
code	Botanical name	N	G	V	N	G	V	N	G	V	N	G	V	N	G	V	N	G	V	
4	*Albizia schimperiana*	83	0.47	1.31	8	0.14	0.63	7	0.36	2.98				3	0.56	5.17	102	1.53	10.09	0.219
6	*Apodytes dimidiata*	12	0.01	0.01							1	0.13	1.52				13	0.14	1.53	0.052
1	*Bersama abyssinica*	12	0.01	0.02				1	0.05	0.39	1	0.13	1.46	3	0.48	3.63	17	0.68	5.50	0.064
14	*Cassipourea malosana*				2	0.03	0.15	2	0.08	0.52	1	0.08	0.60				5	0.19	1.27	0.026
19	*Celtis africana*	12	0.01	0.02													12	0.01	0.02	0.048
2	*Croton macrostachyus*	12	0.09	0.42	4	0.07	0.41	3	0.17	1.44	2	0.20	1.91	6	1.37	14.39	28	1.91	18.57	0.092
3	*Diospyrus whyteana*	12	0.09	0.32													12	0.09	0.32	0.048
8	*Ekerbegia capensis*	71	0.18	0.62				1	0.05	0.29	1	0.12	1.20				73	0.35	2.11	0.179
9	*Erythrococca kirkii*	12	0.01	0.02													12	0.01	0.02	0.048
10	*Euclea natalensis*	35	0.28	1.11	6	0.14	0.82	2	0.09	0.69	1	0.13	1.27	1	0.15	1.85	46	0.78	5.74	0.132
30	*Ficus sp.*							2	0.13	0.76				1	0.20	2.50	3	0.33	3.26	0.017
11	*Lausonia lucida*	83	0.29	1.22	10	0.20	1.26	2	0.11	0.69	1	0.11	0.86				95	0.71	4.03	0.211
13	*Lipiana javanica*	35	0.04	0.05													35	0.04	0.05	0.110
5	*Maytenus senegalensis*	24	0.07	0.10													24	0.07	0.10	0.082
21	*Mystozylon aethiopicum*				7	0.15	0.89	1	0.04	0.20	1	0.09	0.68				10	0.27	1.78	0.041
22	*Nuxia congesta*				1	0.02	0.13	2	0.11	0.84				3	1.52	16.78	6	1.65	17.75	0.030
23	*Ochna holstii*	12	0.01	0.02													12	0.01	0.02	0.048
15	*Olea africana*				1	0.02	0.13	2	0.13	1.18							3	0.15	1.31	0.017
17	*Psychondria mahonii*	12	0.09	0.56													12	0.09	0.56	0.048
31	*Rhoicissus tridentata*							1	0.08	0.79							1	0.08	0.79	0.007
24	*Rhothmannia fischeri*	35	0.21	0.67	2	0.03	0.10	3	0.15	1.66							41	0.39	2.42	0.121
25	*Rhus natalensis*	130	0.28	0.84	5	0.11	0.54	1	0.07	0.49	3	0.28	2.59				139	0.73	4.46	0.260
18	*Schrebera alata*	12	0.01	0.01													12	0.01	0.01	0.048
26	*Syzgium guineense*													2	0.82	9.86	2	0.82	9.86	0.012
28	*Teclea nobilis*	366	1.14	3.61	18	0.25	1.27	7	0.33	2.05	1	0.10	0.72	1	0.18	1.38	393	2.00	9.03	0.368
27	*Vangueria infausta*				3	0.05	0.27										3	0.05	0.27	0.017
Grand Total		967	3.29	10.92	69	1.22	6.60	39	1.94	14.98	14	1.35	12.81	21	5.30	55.57	1111	13.10	100.87	2.344

Appendix 3: Distribution of N, G and V by species and diameter classes and Shannon-Wiener (H') species diversity indices of standing crop in Nyumba-Nitu TFR (2009)

Spp code	Botanical name	BDH classes (cm)																		
		I			II			III			IV			V						
		1 - 10			10.1 - 20			20.1 - 30			30.1 - 40			> 40.1			Total			
		N	G	V	N	G	V	N	G	V	N	G	V	N	G	V	N	G	V	H'
4	*Albizia schimperiana*	83	0.18	0.31	13	0.25	0.97	6	0.40	1.72	3	0.29	2.23	3	0.76	3.36	108	1.87	8.58	0.221
6	*Apodytes dimidiata*	12	0.01	0.01													12	0.01	0.01	0.047
1	*Bersama abyssinica*	8	0.04	0.08				0	0.01	0.04	0.3	0.07	0.09				9	0.12	0.21	0.036
14	*Cassipourea malosana*	16	0.08	0.22				1	0.03	0.14	2	0.13	1.20				19	0.24	1.56	0.066
19	*Celtis africana*				2	0.03	0.04	3	0.13	0.80							5	0.16	0.83	0.025
20	*Clausea anisata*	24	0.08	0.16	1	0.01	0.01	5	0.25	1.25							30	0.33	1.42	0.094
2	*Croton macrostachyus*	24	0.11	0.19	10	0.19	0.90							5	1.10	10.52	38	1.39	11.60	0.113
3	*Diospyrus whyteana*	12	0.05	0.13													12	0.05	0.13	0.047
7	*Dombeya sp.*	12	0.09	0.24	5	0.07	0.22										17	0.17	0.46	0.062
8	*Ekerbegia capensis*	12	0.03	0.05	3	0.05	0.16	3	0.14	0.84	1	0.11	0.78	2	0.45	5.28	21	0.79	7.10	0.074
9	*Erythrococca kirkii*	35	0.07	0.16	1	0.02	0.11										36	0.09	0.27	0.109
10	*Euclea natalensis*	12	0.01	0.01	3	0.07	0.27	1	0.04	0.17							16	0.11	0.45	0.059
30	*Ficus sp.*													2	0.73	2.15	2	0.73	2.15	0.012
11	*Lausonia lucida*	35	0.13	0.49	7	0.13	0.28	2	0.11	0.82							45	0.37	1.59	0.126
12	*Lepidotrichilia volkensii*	35	0.09	0.11	2	0.04	0.25	1	0.07	0.49				1	0.13	1.35	40	0.34	2.19	0.115
13	*Lipiana javanica*				1	0.01	0.06										1	0.01	0.06	0.006
5	*Maytenus senegalensis*							1	0.04	0.31							1	0.04	0.31	0.006
21	*Mystozylon aethiopicum*	118	0.55	1.19	14	0.27	0.98							5	1.36	14.36	137	2.17	16.53	0.252
22	*Nuxia congesta*	12	0.02	0.02	1	0.02	0.03	3	0.18	1.05	1	0.08	0.57	8	2.13	12.73	26	2.42	14.40	0.084
23	*Ochna holstii*	35	0.11	0.28	1	0.01	0.01										36	0.12	0.30	0.109
15	*Olea africana*	12	0.05	0.23	1	0.02	0.06	1	0.05	0.20							14	0.12	0.49	0.053
16	*Prunus africana*	12	0.01	0.01													12	0.01	0.01	0.047
17	*Psychondria mahonii*				1	0.03	0.17							1	0.14	1.44	2	0.17	1.62	0.012
31	*Rhoicissus tridentata*	5	0.01	0.01													5	0.01	0.01	0.023
24	*Rhothmannia fischeri*	7	0.01	0.01	2	0.03	0.25	2	0.09	0.44				2	1.08	13.75	13	1.21	14.45	0.051
25	*Rhus natalensis*	71	0.45	0.77	12	0.17	0.68	1	0.04	0.06							84	0.66	1.50	0.189
18	*Schrebera alata*	9	0.05	0.07													9	0.05	0.07	0.038
26	*Syzgium guineense*	50	0.15	0.44	13	0.21	0.79	2	0.11	0.61				2	0.62	7.57	67	1.09	9.40	0.165
28	*Teclea nobilis*	189	0.74	2.70	27	0.46	1.79	18	0.89	4.56	2	0.22	0.95	1	0.43	4.76	236	2.75	14.77	0.324
29	*Tecomaria capense*				5	0.06	0.18										5	0.06	0.18	0.025
27	*Vangueria infausta*	94	0.45	0.94	6	0.10	0.41	1	0.04	0.16							102	0.59	1.51	0.213
Total		932	3.56	8.82	132	2.26	8.64	53	2.62	13.64	9	0.90	5.82	34	8.94	77.25	1161	18.28	114.17	2.802