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Potential role of sacred groves in biodiversity conservation in Tanzania

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SUMMARY

Sacred groves, some as old as several centuries, may have contributed to the preservation of some plant species in Tanzania. This has led conservationists to consider whether sacred groves could be used for *in situ* conservation. Eight sacred groves of the Ugunda chieftaincy of the Wanyamwezi in central Tanzania representing burial sites that varied from 6–300 years old were inventoried to compare woody species richness and taxonomic diversity with those of forest plots in a state managed Forest Reserve. Although they occupied a relatively small area the sacred groves had greater woody species richness and taxonomic diversity than the state managed Forest Reserve. The forest plots and the groves shared a species similarity index of 45%, suggesting that the sacred groves contributed to *in situ* conservation of the *miombo* woodland biodiversity. Some of the woody species were absent in the forest plots, also suggesting that groves served as a refuge for some species. An inventory of all existing sacred groves could provide important information on their role in *in situ* conservation. In order to promote them for community-based conservation of biodiversity the government should declare sacred groves as preservation sites, and incorporate them into modern conservation systems.

Keywords: *in situ* conservation, biodiversity, forest reserve, *miombo* woodlands, sacred groves, species richness, Wanyamwezi chieftaincy, Tanzania

INTRODUCTION

Local community participation in conservation of biodiversity takes various forms, including ownership and management of trees (Stave *et al.* 2001), the use of hills and mountains as venerated sites (IUCN [World Conservation Union] 1997) and the protection of individual trees that are used as shrines and for spirit worship (Chandarakanth & Jeff 1991; Msuya 1998; Mgumia 2001). However, the most widespread practice involves sacred groves that represent cultural landscapes (Odera 1997; Posey 1999; Laird 1999). They occur in different forms such as remnants of old forests (Millar *et al.* 1999), burial grounds (Falconer 1992) and sites of ancestral worship (Githitho 1998). While sacred groves were not created for biodiversity conservation (see Bharuch 1999), their complex social-spiritual associations with deities and spirits of dead ancestors have contributed to the protection of some ecosystems (Unesco [United Nations Educational, Scientific and Cultural Organization] 1998).

Sacred groves often comprise small patches of forests but, because they frequently represent a higher concentration of floral diversity than managed forest ecosystems (see Bharuch 1999), they can be considered a refuge for endangered species (Falconer 1992). In the Western Ghats in Maharshtra, India, Bharuch (1999) reported that 40 sacred groves varied in size from 30 ha to <1 ha, while in Ghana an area of 4 km^2 had more than 20 shrines and sacred groves, with average sizes of 2 ha (Millar *et al.* 1999). The importance of sacred groves as a tool for *in situ* conservation of biodiversity centres on widespread distribution and the roles they play as reservoirs of local biodiversity of threatened species (Laird 1999). These roles are better realized if the sacred groves are inventoried in order to understand the potential they play in *in situ* conservation compared to the state managed forest reserves.

In Tanzania, the *miombo* woodlands (miombo or *muuyombo* is derived from a Wanyamwezi word that refers to *Brachystegia* species; Rogers 1996), are central to the spiritual needs of the local people, with specific trees and blocks of woodlands conserved for cultural and ritual reasons (Morris 1995). Among the Wanyamwezi, conservation of the miombo woodlands is associated with ancestral and spirit worship (Sørensen 1993; Shepherd 1992). In particular, chiefs' burial sites are preserved and venerated. Conservationists are considering whether sacred groves could be used to promote *in situ* conservation of endangered species (IUCN 1997; Unesco 1998). Presently, information on inventories of sacred groves that compares them to natural forest systems is lacking. This study provides an inventory and evaluation of sacred groves for conservation of the miombo woodlands as compared to the protected Uganda State Forest Reserve in central Tanzania. The specific objectives were to: (1) determine if ages of sacred groves had an influence on tree density, stem basal area and woody species richness; (2) examine whether tree species in different groves comprised different populations; (3) determine whether differences between sacred groves and the state managed Forest Reserve plots could be explained in terms of tree density, stem basal area, woody plant species richness, taxonomic diversity, evenness and numbers of plant families; and (4) discuss the implications of sacred groves for *in situ* conservation of biodiversity in general.

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METHODS

Study area

The study was conducted in the former Ugunda chieftaincy of the Wanyamwezi in the Tabora region, central Tanzania (latitude 5º15´–6º45´S and longitude 31º–34ºE). The topography of the study area is undulating with scattered hills, interspersed with valley bottoms called *mbuga*. The altitude varies from 1100 m–1300 m. The climate is characterized by two rainy seasons (April–May and October–December) alternating with a dry season (June–September). Total annual rainfall is 700 mm–1000 mm. The mean minimum and maximum temperatures are 16.7°C and 28.8°C, respectively (Mitchell 1984).

We selected three villages (*vintoji*) in the Igalula area (5° 40´S, 32°E) in central Tanzania, which was one of the centres of the Ugunda chieftaincy prior to the 19th century, for the current study. The Igalula settlements were spread over an area of about 40 km^2 and were on average located about 10 km from the Ugunda State Forest Reserve. The miombo woodlands dominated the vegetation of the study area. The Wanyamwezi call the common landscape type *isenga,* which is characterized by red sandy soil and is often associated with a greater diversity of miombo woodland species (Mgumia 2001). The Ugunda State Forest Reserve, which covers 5200 km^2, is protected by the state, although traditionally the community used it for honey gathering and livestock grazing. Periodic fires, livestock grazing and exploitation of timber were the main forms of disturbance. At present, the Tanzanian Department of Forestry regulates the use of timber inside the Forest Reserve, while in the buffer zone between the villages and the Forest Reserve local communities are allowed to exploit the non-timber forest resources (Mgumia 2001).

The main inhabitants of the study area are the Wanyamwezi (also called Unyamwezi), who were traditionally divided under different chieftaincies until the 19th century (Abrahams 1967). Politically the chiefdoms had several offices, the most important being that of the ritual priests (*Mgawe*), whose duties are to supervise the installation of chiefs, conduct funeral rites and worship at the chiefs' graves. Although the chieftaincies ended after German colonization in the 1880s, the ritual functions of the burial sites continue to be important among the Wanyamwezi (Mgumia 2001).

Prior to the 19th century, the Wanyamwezi served as a focal point for European explorers, Arab slave traders and large game hunters entering the interior of Tanzania (Abrahams 1967). According to a knowledgeable elder from the Igalula area, prior to the 19th century the Wanyamwezi had 41 chieftaincies (Mzee Haruna interview with Fadhili Hamza Mgumia, October 2000), while Abrahams (1967) reported 31. Since the chiefs' residential areas over the previous centuries have not changed, the majority of the burial sites of the past chiefs were found in the same locality. In the Ugunda chieftaincy there were a total of 10 sacred groves. We selected eight sacred groves near the state Forest Reserve for the current study, while the remaining two, which were located at a site more than 20 km from the Igalula settlements, were excluded, partly because they were not representative of the landscapes in Igalula and partly because of uncertainty about their ages (Mgumia 2001). We inventoried the eight sacred groves and a corresponding preserved core area inside the Forest Reserve, which were all landscapes of isenga type with red sandy soils. With help of the ritual priests and elderly informants, we estimated the approximate ages of the eight sacred groves. The information was cross-checked against historical records (Abrahams 1967).

The groves included that of Mmeta I (300 years old), Kalomo (240 years), Msago I (200 years), Mbeleka I (155 years), Ndisha (120 years), Mmeta II (80 years), Mbeleka II (49 years) and Msago II (6 years) in chronologically descending order (hereafter the sacred groves are referred to by the chiefs' names). The individual groves are circular in shape and protected by a wall made out of *Combretum molle* poles and other ritually significant tree species (Mgumia 2001). All the sacred groves have been colonized by indigenous vegetation. The stand densities were variable but the majority of the sacred groves formed thickets comprising an understorey of tree saplings (5–10 cm stem diameter) and immature (10–20 cm stem diameter) trees and an overstorey of mature trees (>20 cm stem diameter). In this study, only trees with a stem diameter size class ≥10 cm were included in the sample.

Inventories of sacred groves and the Forest Reserve

Different plot sizes were used for sampling because of a high density of plant stems in the sacred groves and sparse tree distributions in the state Forest Reserve. We distributed randomly 2 × 2 m plots in sacred groves, and the total number of plots varied (from 15–60 plots) according to the size of the grove and tree density. We also measured the total area of individual groves. Larger plots (25 × 25 m) were used in the Forest Reserve, where sapling density was low. In the Forest Reserve, the woody vegetation was sampled using a total of 20 plots (each 625 m^2) spaced at 200 m intervals along transect lengths of 4 km, within a landscape matrix of 16 km^2. The sampling of the forest plots was conducted mainly in the core area set aside for preservation. Although different plot sizes were used for sampling sacred groves and the Forest Reserve, the total area of the Forest Reserve plots (1.25 ha) and those of the eight sacred groves (1.20 ha) were comparable. All woody species (including saplings above the cut-off 10-cm stem diameter) found in the plots were counted, and the stem diameter and circumferences were measured to calculate stem basal area for individual trees (saplings were considered as potential trees). Plant samples found in the groves and the state Forest Reserve plots were identified to plant family levels (Palgrave 1992). Voucher samples of the species that could not be identified were deposited at the herbarium of the Miombo Woodland Research Centre in Tabora.

Table 1 Results of inventories of eight sacred groves of the Ugunda Chieftaincy of the Wanyamwezi in central Tanzania: mean grove area (Area), stem density (Density), stem basal area (BA), Shannon-Wiener species diversity index (H′), evenness (E), woody species richness (Species richness) and numbers of plant families. The values have been rounded off.

Groves	*Age (years)*	*Area (ha)*	*Density (stems ha^{-1})*	*BA (m^2 ha^{-1})*	*H′*	*E*	*Species richness*	*Families*
Mmeta I	300	0.2	400	1.8	1.2	0.9	20	11
Kalomo	240	0.2	1261	6.3	1.4	1.0	40	19
Msago I	200	0.2	655	1.8	1.2	0.9	21	14
Mbeleka I	155	0.1	1141	4.5	1.3	0.9	28	16
Ndisha	120	0.1	1552	14.2	1.1	0.9	22	15
Mmeta II	80	0.2	389	2.0	1.2	0.9	21	13
Mbeleka II	49	0.3	362	0.7	1.1	0.9	20	15
Msago II	6	0.1	1172	3.8	1.4	0.9	33	15

Tree species richness and tree stem density, stem basal area, Shannon-Wiener species diversity index (Kent & Coker 1992), evenness and plant species similarity (Chidumayo 1997) were determined both for the sacred groves and the Forest Reserve plots. Plant species dominance in terms of importance value index (IVI; Kent & Coker 1992) was determined for the species that occurred in the sacred groves as well as the Forest Reserve plots. Tree species that were found only in the Forest Reserve plots have been reported elsewhere (Mgumia 2001).

Statistical analyses

Sacred groves as specialized systems of conservation associated with cultural-religious beliefs of the Wanyamwezi were not randomly distributed within landscapes and could not therefore meet the standard rules required for an experimental design. Rather, they might serve in *in situ* conservation in which chronological ages might reflect variations in plant species diversity. In order to test effects of sampling we investigated if plot sizes biased the plant data. Preliminary analysis showed that, with the exception of tree stem density, which was influenced by plot size ($p = 0.011$ for sacred groves), the stem basal area, species richness, Shannon-Wiener species diversity index, evenness and numbers of plant families were not influenced ($p > 0.05$). For the Forest Reserve, plot size explained only 14.8% of the variability of stem density and woody plant species richness as well as 7.9% of the stem basal area.

We therefore used a simple tabulation to compare means from the sacred groves and those of the Forest Reserve plots after necessary data transformation. Data from the two systems were expressed in similar area units (i.e. per ha or m^2). We determined Pearson's correlation between age of groves as the independent variable and tree stem density, stem basal area and plant species richness, as response variables. Listings of tree species in the groves and the Forest Reserve plots were used to determine those harboured by the groves. The percentage of total species represented by individual groves was determined to understand if groves harboured different woody species populations. We used SYSTAT Inc. (1992) for all analyses.

RESULTS

The mean area of the sacred groves was 0.14 ha, ranging from 0.06 ha–0.26 ha. Mean tree stem density was greatest in the Ndisha grove with 1552 trees ha^{-1} and least in the Mbeleka II grove with 362 trees ha^{-1} (Table 1). Mean stem basal area was greater in the Ndisha grove than in the others (Table 1). In the state Forest Reserve plots, mean tree density was slightly lower than that of the sacred groves, while mean basal area was three times greater than those in the sacred groves (Table 2). Among the groves stem basal area was significantly correlated with tree density ($r_s = 0.84$, $p = 0.009$) but was not influenced by the age of the groves ($r_s = -0.073$, $p = 0.864$).

Moreover, age of sacred grove was not correlated with tree species richness (Fig. 1). Among the eight groves tree species

Table 2 Tabular comparisons (means ±SE) of stem density, stem basal area, woody species richness, Shannon-Wiener species diversity index, evenness and plant families between the sacred groves and the State Forest Reserve plots.

Factors	*Sacred groves*	*Forest plots*
Stem density (ha^{-1})	866.4 ± 468	810 ± 230
Stem basal area (m^2 ha^{-1})	4.3 ± 4.0	12.8 ± 3.7
Species richness	25.6 ± 7.4	15.2 ± 5.1
Shannon–Wiener index	1.2 ± 0.1	1.7 ± 0.1
Evenness	0.9 ± 0.02	1.5 ± 0.2
Numbers of plant families	14.8 ± 2.3	9.1 ± 2.9

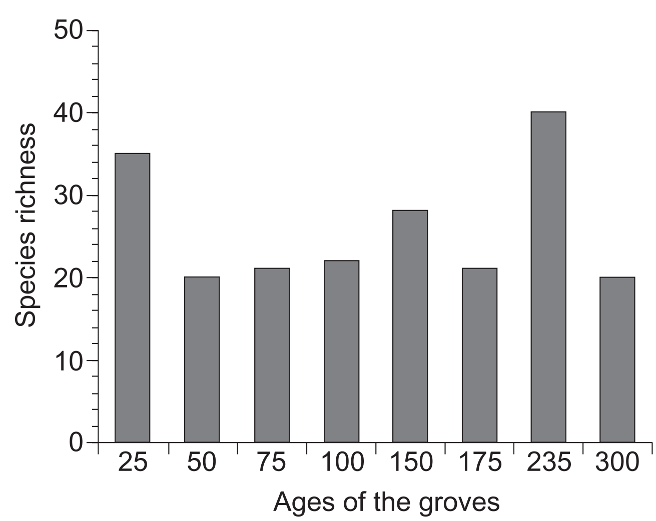

Figure 1 Relationship between the ages of sacred groves and the miombo woody species richness.

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richness was variable (Table 1). The sacred groves had relatively higher tree species richness than the Forest Reserve plots (Table 2). Among the eight sacred groves there were a total of 68 tree species (Table 3). The groves harboured some species that were absent in the Forest Reserve plots and the two management systems shared a species similarity index of 45%.

The sacred groves offered different tree species populations as shown by the varied tree species data (Table 1). However, only two sacred groves accounted for 75% and 53% of total species that occurred in the groves, while others on average accounted for <40% of the total species (Fig. 2). Among the woody species that occurred in the groves as well as in the Forest Reserve plots, *Commiphora mossambicensis* (IVI = 25.61), *Dichrostachys cinerea* (IVI = 25.08), *Strychnos pungens* (IVI = 15.39), *Ziziphus mocronator* (IVI = 12.41) and *Annona senegalensis* (IVI = 9.70) had greatest dominance. The majority had low dominance/lower frequencies. The spatial arrangements of tree species measured by the Shannon–Wiener species diversity index and evenness showed greater values for the Forest Reserve plots than the sacred groves (Table 2). The groves on average had about 15

Table 3 Importance value index (IVI) of woody species present (*a*) in both the sacred grove and the Forest Reserve plots and (*b*) the sacred groves only.

(a) *Sacred groves and Forest Reserve plots*		(b) *Sacred groves only*	
Species	***IVI***	***Species***	***IVI***
Albizia harveyi	6.81	*Albizia petersiana*	2.37
Annona senegalensis	9.70	*Allophyllus africanus*	5.13
Brachystegia specifumis	5.70	*Antidesma venosum*	6.35
Burkea africana	0.70	*Balanites aegyptiana*	0.71
Combretum adenogonium	1.24	*Berchemia discolor*	1.73
Combretum collium	3.80	*Borassua aethiopum*	1.92
Combretum molle	3.01	*Cassia abbreviata*	5.16
Combretum obovatum	2.67	*Commiphora africana*	1.34
Combretum zeyheri	10.82	*Ehretia* sp.	2.19
Commiphora mossambicensis	25.62	*Entada abyssinica*	1.57
Crossopterx febrifuga	3.85	*Erythrina abyssinica*	4.52
Dalbergia melanoxylon	1.16	*Flacourtia indica*	10.42
Dichrostachys cinerea	25.08	*Ficus thonningii*	1.85
Diospyros fischeri	7.14	*Mangifera indica*	3.43
Diospyros mespiliformis	9.27	*Ozoroa insignis*	1.26
Diplorhynchus condylocarpony	2.91	*Parinari curatellifolia*	4.19
Friesodielsia obovata	4.00	*Phyllanthus reticulate*s	8.61
Julbernadia globiflora	2.61	*Premna sinensis*	6.31
Lannea humilis	0.49	*Sterculia mhosy*a	3.47
Lannea schimperi	12.08	*Strychnos innocua*	1.98
Lonchocarpus bussei	6.99	*Tamarindus indica*	1.19
Manilkara mochisia	1.10	*Terminaria sericea*	6.21
Margaritaria discoidea	3.38	Unidentified	2.56
Markamia obtusifolia	2.37	Unidentified	1.16
Ochna longpipes	0.40	*Zanha africana*	0.40
Oldifieldia dactylophylla	0.38	*Zanthoxylum chalybeum*	2.08
Psendolachnostylis maprouneifolia	4.29		
Pterocarpus angolensis	1.17		
Phyllanthus engleri	4.64		
Piliostigma thonningii	4.89		
Pavetta canescena	1.90		
Pericopsis angolensis	0.39		
Phyllanthus engleri	4.64		
Ptercarpus tinctorius	2.10		
Strychnos pungens	15.50		
Strychnos cocculoides	0.90		
Swartizia madagascariensis	0.95		
Terminalia mollis	2.54		
Vitex doniana	2.19		
Xermenia caffra	0.70		
Xerodermis stuhlmannii	2.20		
Ziziphus mocronata	12.4		

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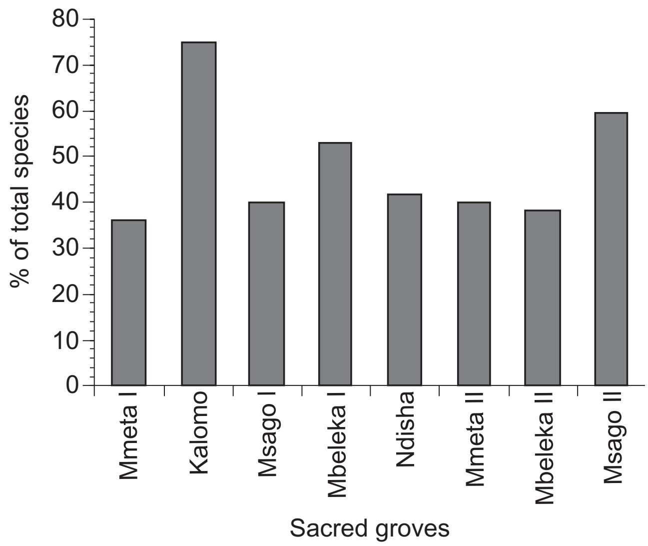

Figure 2 Percentage (%) of the total tree species sampled in the eight sacred groves.

plant families (excluding two species that were not identified) compared to those of the Forest Reserve plots with about 9 plant families (Table 2). The dominant plant families in the sacred groves and the state Forest Reserve plots were Caesalpinoideae, Papilionoideae and Combretaceae. The tree species and plant families in the sacred groves were representative of greater than 60% of the miombo woodland species.

DISCUSSION

The sacred groves and the State Forest Reserve

The potential role of sacred groves in *in situ* conservation was assessed in terms of differences among the groves, as well as for their similarity with the Uganda State Forest Reserve plots. The sacred groves were cultural vegetation patches, while those of the Forest Reserve plots were part of the natural vegetation cover. Thus, when making comparisons between the two management systems some level of subjectivity could not be avoided. We established that plot size did not influence most of the attributes with the exception of stem density and spatial arrangements of plants (see below). The lower stem basal area of trees from the groves compared to those of the Forest Reserve plots suggests that the differences were due to greater sapling density in the former (data not shown). Furthermore, the inventory showed that among the eight sacred groves, changes in tree stem density, basal area and species richness could not be explained by age alone, while site factors were probably important. The specific site factors need to be understood by future research to help explain inter-grove species variability and the roles groves serve as refuges for threatened miombo woodland species. The higher woody species richness and numbers of plant families in the groves as compared to the Forest Reserve plots were probably due to differences related to population factors. However, the superior values of the Shannon-Wiener species diversity index and evenness for the Forest Reserve plots over those of the sacred groves might reflect differences in spatial arrangements of species in the two systems. Species in the groves appeared less evenly distributed compared to those in the state Forest Reserve plots. It is probable that the groves represented different tree species populations (Fig. 2). Considering the spatial context of the landscape matrix within which the groves were embedded (in 40 km^2 landscapes), it is probable that the overall effects of sacred groves were to create patchiness of miombo woodlands that in turn created greater diversity of woody species. This is especially important given that the sacred groves were representative of 60% of the species of the miombo woodlands.

In the majority of the groves only few species occurred at greater frequencies, while most occurred at lower frequencies (in terms of importance value index). Some of the less frequent species harboured by the groves were probably those that were conserved. The absence of some species from the state Forest Reserve plots and their presence in the sacred groves probably reflected effects of management (Mgumia 2001). Although the majority of the miombo woodlands are adapted to fire (Rodgers 1996), absence of some species from the Forest Reserve plots suggests that they were probably intolerant to disturbance. For the explanation of fire intolerant species, we lack empirical evidence on the natural history of individual species and their response to management. However, although the extent to which the sacred groves contributed to the conservation of endangered miombo woodland species compared to the State Forest Reserve was unknown, the greater species richness and numbers of plant families in the groves were indicators that it contributed to the preservation of some woody species. Such evidence might support the consideration of conservationists for promoting sacred groves for *in situ* biodiversity conservation.

Implications of sacred groves for *in situ* conservation of biodiversity

The sacred groves indicate great potential for *in situ* conservation of biodiversity. Proper understanding of their contribution to conservation has, however, been hampered by lack of comparative data. Researchers who reported higher plant species richness in sacred groves worldwide did not report values for adjacent managed forest ecosystems. In Nigeria, 121 species were found in sacred groves (Okafor & Lapido 1995), while in India, 318 plant species belonging to 86 families were reported from Kerala's sacred groves (Rajendraprasad *et al.* 1998). In Sierra Leone, Lebbie and Guries (1995) reported 82 species in sacred groves. In none of these studies was any information provided on biodiversity of natural forest systems. If sacred groves are to serve an important role in conservation of biodiversity, then it is obligatory for researchers to supply comparative data. Moreover, integrating the sacred groves into formal conservation systems will require a greater understanding of the specific spiritual roles they play that contributes to their preservation.

The trees in the groves we studied were preserved for worshipping (Mgumia 2001). Lebbie and Guries (1995) reported that sacred groves in Sierra Leone are protected against overexploitation by sanctions and taboos and only certain groups of people are allowed access. In India, sacred groves are protected through social taboos (Gadgil & Vartak 1975) usually associated with some deity (Rajendraprasad *et al.* 1998). Out of the taboos surveyed through literature, 30% provided protection to species that are listed on the IUCN list of threatened species (Colding & Folke 1997). Sacred groves in Sierra Leone conserved plant species that are mainly used for medicinal purposes (Lebbie & Guries 1995), while in Nigeria, sacred groves serve as preservation units against overexploitation of forest resources (Okafor & Lapido 1995). Among the Wanyamwezi there are rules that govern sacred groves. Visits to gravesites are prohibited except with permission from the ritual priests. In addition, the sacred groves are protected from exploitation, while removal of plant parts for medicinal purposes requires ritual performance.

Despite the important roles the sacred groves may play in conservation of biodiversity worldwide, doubts have been expressed whether this traditional system of conservation can be made operational in formal forest conservation systems. First, the elaborate socio-ritual systems that operate through sanctions are culturally specific (see Laird 1999; Mgumia 2001) and difficult to replicate in all situations. Second, given the cultural changes as well as changes in resource tenure, state conservation agencies such as the Department of Forestry are often under no obligation to promote sacred groves as indigenous systems of preservation. On the contrary, ritually protected forests, which the local communities have preserved for many centuries, may be alienated by the state for the settlement of landless populations or cultivation of commercial crops. In Kenya, the threat of alienation of the Mau forest, which is spiritually important to the Masai, provides such an example (Fitz-Henry & Olol-Dapash 2002). There are exceptions where state agencies have contributed to preservation of sacred groves (Posey 1999). The main constraint is insufficient funding to local communities, lack of baseline information on sacred groves in general and lack of understanding as to their contributions to formal conservation worldwide. For example, the majority of the sacred groves that have been conserved by different local communities in Tanzania have not been documented.

On the positive side, the sacred grove system of *in situ* conservation of biodiversity has a number of advantages which management in the future should consider. First, the system is widespread, especially among the African, Asian and Latin American countries, and would, at local levels, contribute significantly to preservation of biodiversity. Second, sacred groves and their diverse origins have universal spiritual functions, which suggests that they might share systems of rules, taboos and sanctions. For example, the Masai used forestlands and mountains as opposed to the graves of their ritual leaders as sacred sites for conducting prayers and these have resulted in the environment being protected (L. Mulenkei, unpublished data 2000). Similarly, the Gabbra pastoralists of the northern Kenya/Ethiopian borderlands have preserved ritual sites (Schlee 1992). The Wanyamwezi directly contribute to *in situ* conservation, although the goal was of spiritual significance rather than biodiversity conservation. Third, ritual sites including the sacred groves, shrines and mountains are protected from destructive activities through taboos and customary rules (Laird 1999). Resources within the protected areas are either completely preserved or the use is highly regulated (Falconer 1992). Among the Wanyamwezi, the weakening of their institutions for managing sacred groves (Mgumia 2001) and their neglect by the Department of Forestry will, however, have to be addressed if sacred groves are to have a role in formal *in situ* conservation of biodiversity. The growing interests by international conservation agencies, such as the WWF and IUCN among others, concerned with cultural survival of indigenous peoples as part of the global efforts for conserving biodiversity, could have beneficial influence on protection of the sacred groves (Posey 1999). Promotion of sacred groves for conservation should be considered within the broader context of indigenous natural resource management systems (Gadgil *et al.* 1993; Berkes *et al.* 1998).

CONCLUSIONS

Conservationists need information in order to appreciate the global significance of sacred groves for *in situ* conservation of biodiversity. Although the groves served as a refuge for some species, they would not replace conservation in larger landscapes. Rather, they should be complementary to that of the state Forest Reserve. Sacred groves and ritual sites represent a potential contribution to conservation of biodiversity especially in fragmented landscapes. For this reason, sacred groves are of great research value in *in situ* conservation of threatened species. Understanding the potential roles played by sacred groves and other religiously sanctioned sites for *in situ* biodiversity conservation worldwide would have greater appeal if efforts were made to inventory the existing sacred groves, especially those known to harbour species that might be facing extinction. As a step in this direction the Tanzanian government should support research efforts to inventory all the groves of the Wanyamwezi chieftaincies. Additionally, by declaring sacred groves as preservation sites with legal status, *in situ* conservation of biodiversity will perhaps be promoted. Conservation of sacred groves should be part of the communities' efforts, where local people serve as guardians within the framework of social forestry conservation.

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