

# Seeing the wood for the trees: an assessment of the impact of participatory forest management on forest condition in Tanzania

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**Abstract** Over the past 15 years the Tanzanian government has promoted participatory forest management (both joint forest management and community-based forest management) as a major strategy for managing natural forests for sustainable use and conservation. Such management is currently either operational or in the process of being established in > 3.6 million ha of forest land and in > 1,800 villages. Data from three case studies of forests managed using participatory and non-participatory forest management approaches suggest that community involvement in forest management is correlated with improving forest condition. In our first case study we demonstrate increasing basal area and volume of trees per ha over time in miombo woodland and coastal forest habitats under participatory forest management compared with similar forests under state or open access management. In our second case study three coastal forest and sub-montane Eastern Arc forests under participatory forest management show a greater number of trees per ha, and mean height and diameter of trees compared to three otherwise similar forests under state management. In our third case study levels of cutting in coastal forest and Eastern Arc forests declined over time since initiation in participatory forest management sites. We conclude that participatory forest management is showing signs of delivering impact in terms of improved forest condition in Tanzanian forests but that further assessments need to be made to verify these initial findings.

**Keywords** Eastern Arc, forest condition, participatory forest management, sustainable use, Tanzania.

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## Introduction

Tanzania contains an estimated 34.6 million ha of forest and woodland habitats. The main forest types are the extensive miombo woodlands in lowland areas across the central and southern parts of the country (White, 1983), the *Acacia* woodlands in the northern regions (White, 1983), the coastal forest/woodland mosaic in the east (Burgess & Clarke, 2000), mangrove forests along the Indian Ocean (White, 1983), and closed canopy forests on the ancient mountains of the Eastern Arc in the east (Lovett & Wasser, 1993; Burgess *et al.*, 2002; Burgess *et al.*, 2007), in the Albertine Rift in the west (Plumptre *et al.*, 2007), and on the younger volcanic mountains in the north (White, 1983).

Of these various forest types, 14.3 million ha are found within gazetted Forest Reserves, 2.5 million ha are proposed as Forest Reserves and *c.* 2 million ha are in Game Reserves or National Parks (URT, 2001; Akida & Blomley, 2006). Forest Reserves fall under the legal authority of central government (National Forest Reserves), local government (Local Authority Forest Reserves), or village government (Village Land Forest Reserves and Community Forest Reserves) and are either designated for production (managed for timber and other productive uses) or protection (managed for water catchment or biodiversity conservation functions). The remaining 15.8 million ha of forest, found outside the reserve network, lies on village and general land (URT, 2001; Akida & Blomley, 2006). Whereas many of these unreserved forests are poorly managed, traditional and customary management practices have also supported the conservation and maintenance of forest cover for sacred, religious or social purposes (Mgumia & Oba, 2003; Monela *et al.*, 2005).

The management of Tanzanian Forest Reserves dates back to the German colonial period and has mainly been characterized by policing, exclusion and enforcement of laws. From the mid 1980s a broad international movement, starting in Asia but spreading rapidly to Africa, stressed the decentralization and delegation of forest management rights and responsibilities to the local level to enhance sustainable forest management (Wily, 2002). Drawing upon common-pool resource theory it was assumed that forests can be better managed when forest users are involved in making and adapting rules on the exclusion or inclusion of participants, defining their obligations, agreeing appropriate management strategies, monitoring impacts and resolving conflicts (Ostrom, 1999).

After a long period of debate, pilot activities involving local communities in forest management were started in northern and eastern Tanzania in the mid 1990s (Wily, 1998). Key responsibilities for forest management were transferred from central to village government, representing a major shift in the Tanzanian approach to forest management. Following the success of these pilot projects other forest areas across eastern and southern Tanzania were brought under community management or community/government co-management (Blomley, 2006).

In parallel to the development of pilot projects, a review was conducted of Tanzanian forest policy (URT, 1998) and legislation (URT, 2002) that, together with sweeping reforms in Tanzania's economic and political spheres, provided a favourable legal environment for advancing participatory forest management where local communities either alone, or together with government authorities, manage natural forest resources for sustainable use and conservation purposes (Blomley, 2006; Blomley & Ramadhani, 2006). Mainland Tanzania now has one of the most advanced community forestry jurisdictions in Africa as reflected in policy, law and practice (Wily, 2000; Lund & Nielsen, 2006).

The three stated policy objectives of participatory forest management in Tanzania are (1) improved forest quality through sustainable management practices, (2) improved livelihoods through increased forest revenues and secure supply of subsistence forest products, and (3) improved forest governance at village and district levels through effective and accountable natural resource management institutions (URT, 2003). Despite significant expenditure by the Tanzanian government and development partners to support such management (currently *c.* USD 1.9 million per year), there have been few attempts to evaluate whether participatory forest management is achieving these objectives and hence to make recommendations on the way forward with this major forest management strategy.

Here we assess the success of implementing participatory forest management in Tanzania over the past 15 years and in relation to the first objective of improving forest condition. Success is measured firstly in terms of the absolute area of forests now under such management arrangements and, secondly, in terms of the impact of such management on forest quality. We also draw conclusions that relate to the further implementation of participatory forest management in Tanzania.

## Methods

### Definitions

Two main approaches for implementing participatory forest management are being promoted in Tanzania (URT, 2006). The first approach is joint forest management. This is a collaborative management strategy that divides forest

management responsibility and returns between the forest owner (usually central or local government but occasionally the private sector) and communities living adjacent to the forest. It takes place on land reserved for forest management such as National or Local Authority Forest Reserves. The second approach is community-based forest management. This takes place in forests on village land, i.e. land that has been surveyed and registered under the provisions of the Tanzanian Village Land Act (URT, 1999) and managed by the village council. The village council and the village assembly are elected institutions that form the basis of village governments in Tanzania (of which there are > 10,500). Under community-based forest management villagers take full ownership and management responsibility for an area of forest within their jurisdiction, and it is declared by village government as a Village Land Forest Reserve and registered by the district council. The underlying policy goal of community-based forest management is to bring large areas of unprotected woodlands and forests under village management and protection.

### Status inventory

We undertook an assessment of the spread and current extent of participatory forest management across mainland Tanzania. Data were gathered by staff in the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism. The approach involved sending inventory sheets to each of the 126 districts in mainland Tanzania, and to all forestry projects and NGOs active in the facilitation of participatory forest management at the local level. Data returned from 83 of these sources were tabulated and checked. This inventory is presented in terms of the adoption of participatory forest management over time in different districts and regions, within different forest/woodland vegetation types, and across different tenure and management regimes.

### Measurement of impact

We analyse changes in forest condition using data from three case studies that used somewhat different study designs and data collection methodologies. The first case study is of temporal changes in forest condition under participatory and non-participatory forest management. Data were gathered from 13 forests over 1997–2007 in five regions across eastern, central and northern Tanzania (Fig. 1; Table 1). The sample includes nine forests with community-based management, two with joint forest management, one under exclusive local government management, and one in open access land owned by a village but lacking forest management objectives. Field data were collected in 20 × 20 m permanent sample plots in which basal area, volume and stems per ha were measured over

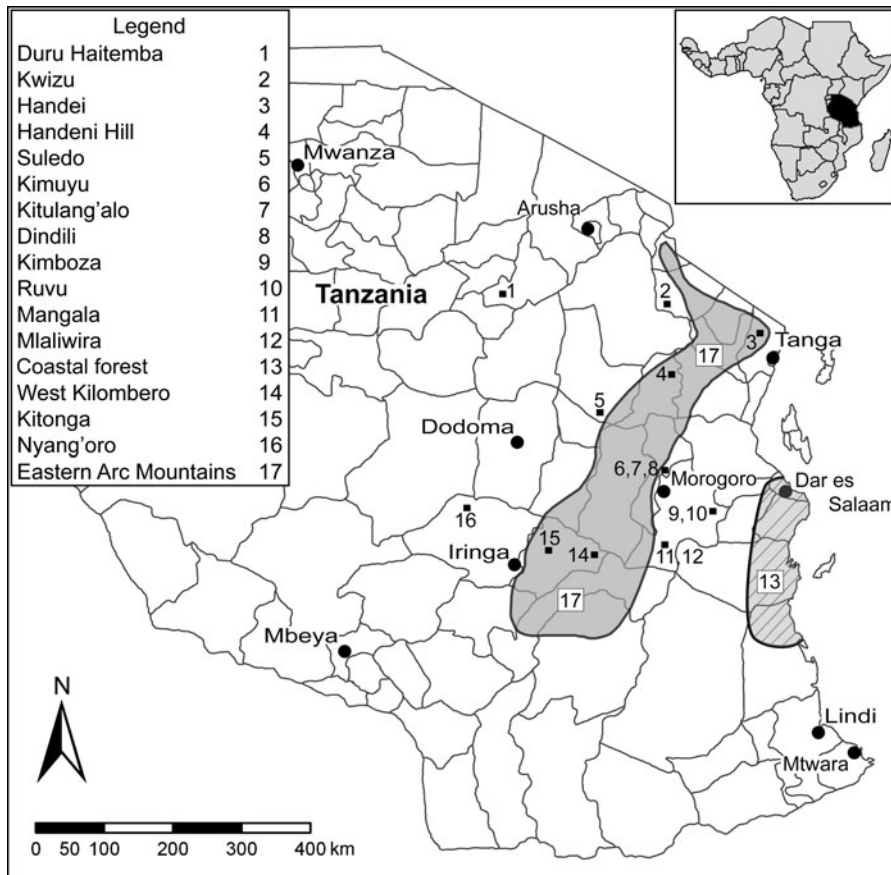


FIG. 1 Tanzania, with the location of the sites mentioned in the text. The inset indicates the location of the main figure in East Africa.

a minimum of 2 and a maximum of 10 years. A total of 246 forest plots from the 13 sites were assessed.

The second case study is a spatial comparison of forest condition in three matched pairs of forests under participatory and non-participatory forest management. Data on forest condition were collected in 2005–2006 using retrospective experimental design (De Vaus, 2002). The six Forest Reserves in Morogoro Rural and Kibaha Districts were arranged in three paired sets, each set including one under joint forest management (the experimental group) and the other under traditional state management (the control group; Table 2). At each site data were collected on forest condition using transects 10 m wide and 1 km in length, aligned on a base map either north-south or east-west, and positioned randomly within the forest. The area sampled was 0.4–0.6% of the total forest area. Methods followed those developed by Frontier-Tanzania (Frontier Tanzania, 2001; Ahrends, 2005). Each transect was subdivided into 10 × 50 m sampling units, or plots. Within each plot the number of live, naturally dead, old cut and recently cut timber trees, poles and withies were recorded. Timber trees were defined as all trees with a diameter at breast height (DBH) > 15 cm and a straight stem of at least 3 m; poles as 5–15 cm DBH with a straight stem of at least 2 m, and withies (locally known as *fitu*) of 2.5 ≤ 5 cm DBH

with a straight stem of at least 2 m. A timber tree, pole or withy was classified as recently cut when the cutting surface was still a fresh cream or green colour with no blackening or any other signs of decomposition. Depending on a variety of factors, signs of decomposition are visible over 0–6 months. Detailed DBH measurements were taken for each recorded timber tree at the standard height of 1.3 m above ground, and the height of each such tree estimated. For each plot any other human use of forest resources was also recorded and included: burn marks on trees, traps and snares, pit-saw timber harvesting sites, charcoal production pits, farming (both old and recent), mining, debarking for medicinal use, the use of parts of trees for tool making, and evidence of grazing.

The third case study is a spatial comparison of forest condition in 49 forests under joint and non-joint forest management. Data on forest condition were compiled from a total of 477 km of transects in the Eastern Arc Mountain forests and lowland coastal forests that have been surveyed between 1997 and 2005 using the same Frontier-Tanzania transect methodology as described for the second case study. Forest disturbance information was analysed for 24 Forest Reserves under joint forest management and 25 Forest Reserves under exclusive local or central government management.

TABLE 1 Study sites and characteristics of the 13 forests (Fig. 1) under various management regimes assessed during 1997–2007.

Time interval between studies	Study area/ forest name	Village name and district	Forest type	Management regime	Legal status	Source
2005–2006	Handei	Magambo-Miembeni Village, Muheza District	Miombo	Community-based forest management	Village Land Forest Reserve	Zahabu (2006a)
2005–2006	Mangala	Ludewa Village, Morogoro District	Coastal forest			Zahabu (2006b)
2006–2007	Duru-Haitemba	Ayasanda Village, Babati District	Miombo			Zahabu (unpubl. data)
2006–2007	Warib					
1997–2007	Suledo	Five villages in Kiteto District	Miombo			Isango (2007)
2005–2006	Kimuyu	Gwata Village, Morogoro District	Miombo			Zahabu (2006b)
2002–2005	Nyang'oro	Six villages in Iringa District	Miombo			Isango (2006)
2002–2005	Kitonga	Kitonga Village, Iringa District	Miombo			Isango (2006)
2002–2005	West Kilombero	Udekwa Village, Iringa District	Eastern Arc/miombo			Isango (2006)
2005–2006	Kitulang'alo	Morogoro District	Eastern Arc/miombo	Joint forest management	National Forest Reserve	Zahabu (2006b)
2001–2004	Handeni Hill	Handeni District	Eastern Arc/coastal forest/miombo			Luoga <i>et al.</i> (2003)
2000–2003	Kwizu	Same District	Eastern Arc/miombo	Government only	Local Authority Forest Reserve	Kajembe <i>et al.</i> (2006)
2002–2006	Unmanaged area outside forest reserve in vicinity of Kitulang'halo	Morogoro District	Miombo	Open access	Village Land	Malimbwi <i>et al.</i> (2005)

TABLE 2 Study sites and characteristics of the three joint and three non-joint forest management forests around the Uluguru Mountains (Fig. 1).

Study site	Forest size (ha)	Forest type	Legal status	Management regime	No. of 50 m sample sections	% of total forest area sampled
Kitulang'alo	2,238	Miombo/Eastern Arc	National Forest	Joint Forest	169	0.4
Kimboza	405	Coastal forest	Reserve (Protection)	Management	80	0.4
Mlaliwira	13	Coastal forest/Eastern Arc	Local Authority Forest Reserve (Protection)		60	0.6
Dindili	1,007	Miombo/Coastal forest	National Forest	Exclusively central government	310	0.5
Ruvu	3,094	Coastal forest	Reserve (Protection)	government	20	0.4
Ngambaula	2.8	Coastal forest/Eastern Arc	Local Authority Forest Reserve (Protection)	Exclusively local government	20	0.4

## Results

### Spread of participatory forest management

Over the past 15 years participatory forest management has spread rapidly from a few pilot sites to being operational in 53 districts (out of a total of 126) across mainland Tanzania, in over 1,800 villages (18% of total), and across > 3.6 million ha of forest land (11% of total). By 2006, joint forest management was being implemented in 209 Forest Reserves nationwide (34% of National and Local Authority Forest Reserves), of which 150 are National and 59 Local Authority Forest Reserves. At present 1.37 million ha (85% of the total forest area covered by joint forest management arrangements) are found in National Forest Reserves and 1.26 million ha (or 78% of the total area) in forests managed for water catchment and biodiversity conservation purposes (Table 3). Community-based forest management is being implemented on 2.06 million ha of forest land with 1,102 villages. Currently there are 329 Village Land Forest Reserves that have been declared by village and district governments and an additional 53 that have been declared through the optional national gazettelement and registration process.

In 2006 57% of the 1.6 million ha of land covered by joint forest management agreements was in high biodiversity montane evergreen forest, primarily located within the Eastern Arc Mountains and lowland coastal forests in the east of the country (Table 4). In addition, of the estimated 172,900 ha of mangrove forest and salt pans on mainland

Tanzania and Pemba (Semesi, 1992), which are by law under the authority of central government, 65% is covered by joint forest management. In comparison, over two-thirds of the 2.06 million ha covered by community-based forest management is found in miombo woodland habitats, which are of low biodiversity importance and more tolerant of disturbance.

### Impact of participatory forest management

*Temporal changes in forest condition* In the 13 forests sampled there were increases in basal area and volume in sites managed under both joint and community-based forest management, and declines in both of these variables in forests under government or open access management (Fig. 2a,b). There were also declines in stems ha<sup>-1</sup> in forests managed under community-based forest management, and increases in joint forest management areas and forests under exclusive state management (Fig. 2c). Although the data come from different areas of Tanzania and different ecological conditions, they tend to suggest that forest areas managed under joint and community-based forest management are recovering compared with forests managed by government alone, or under open access regimes.

*Six forests under joint and non-joint management* In the spatial comparison of forest condition in three matched pairs of lower altitude coastal/Eastern Arc forest and miombo woodlands around the Uluguru Mountains, those

TABLE 3 Distribution of joint forest management (JFM) across Forest Reserves under the authority of central and local government, managed for protection and production purposes.

	National Forest Reserve (ha; n = 150)	Local Authority Forest Reserve (ha; n = 59)	Total	% of total area under JFM
Protection	1,136,788	120,423	1,257,211	77.7
Production	232,575	128,190	360,765	22.3
% of total area under JFM	84.6	15.4	100	100
<i>Total</i>	1,369,363	248,613	1,617,976	100



TABLE 4 Distribution of community-based and joint forest management across the main forest types of mainland Tanzania by June 2006.

Forest type	Community-based forest management		Joint forest management	
	Estimated area (ha)	% of total area	Estimated area (ha)	% of total area
Montane evergreen forest	12,051	1	849,102	57
Mangroves	0	0	111,543	7
Coastal forests	308,814	15	193,100	12
Miombo woodlands	1,399,805	68	326,022	20
Acacia woodlands & thickets	339,937	16	138,209	9
<i>Total</i>	2,060,608	100	1,617,976	100

under joint forest management have higher numbers of live and naturally dead trees, poles or withies, and fewer cut timber trees, compared with forests managed exclusively by the state (Fig. 3a-c). The average number of trees was 13.8 and 9.2 in joint and non-joint forest management plots, respectively, average DBH of standing trees was 28.4 and

22.9 cm, respectively, and average height of standing trees was 13.3 and 9.9 m, respectively (Fig. 4a-c). Forests under joint management also have 68% fewer freshly cut timber trees than in non-joint forest management areas, whereas incidences of freshly cut trees for poles was 70% less frequent in the former than in the latter. Similarly, there

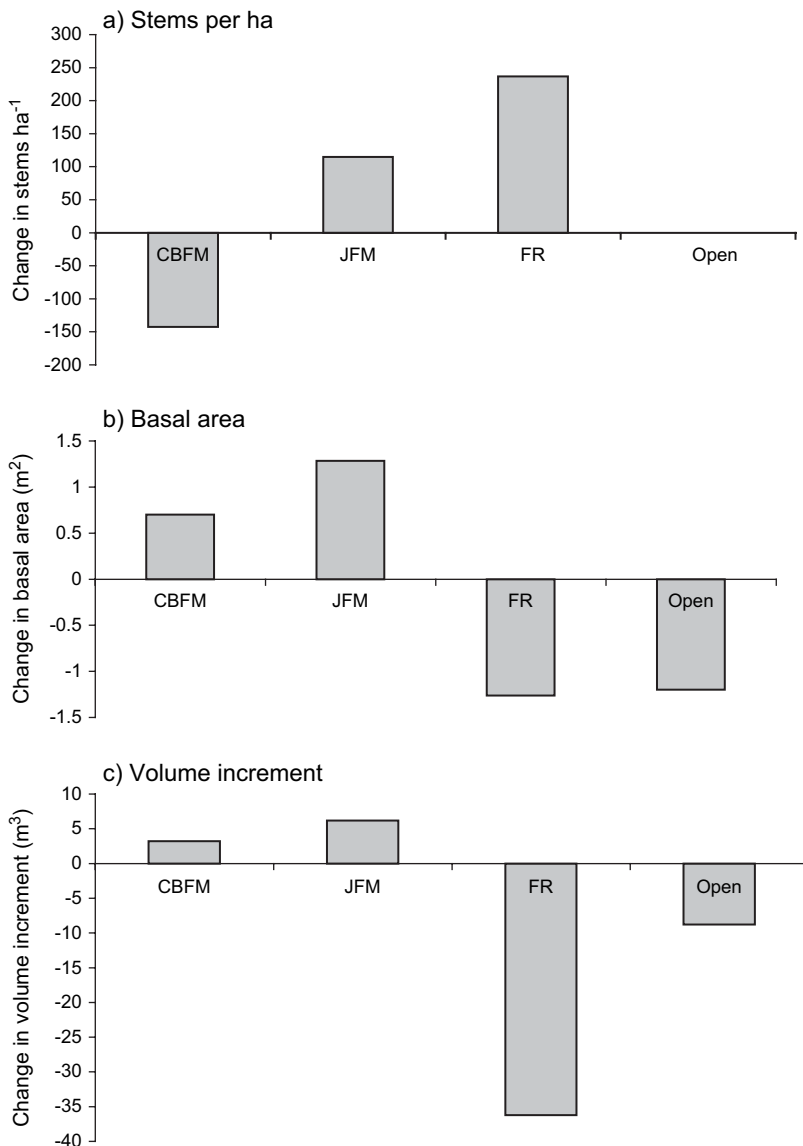


FIG. 2 Mean annual changes in (a) stems per ha, (b) basal area, and (c) volume increment in 13 forests under different management and ownership regimes: nine under community-based forest management (CBFM), two under joint forest management (JFM), one under local government management as Forest Reserves (FR), and one an open access area (Open).

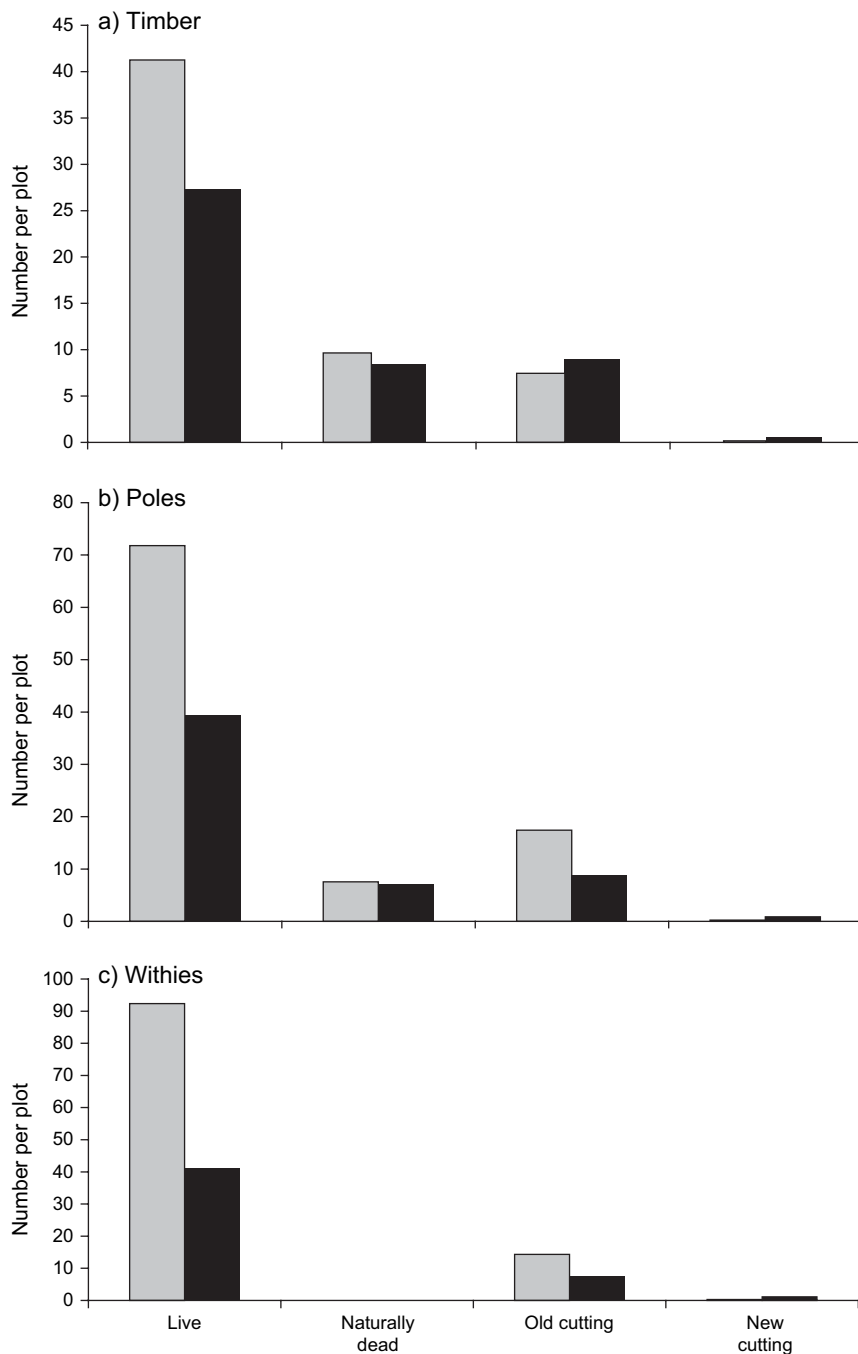


FIG. 3 Number of live, naturally dead, old and new cut trees per plot suitable for (a) timber, (b) poles, and (c) withies in three joint (grey) and three non-joint forest management (black) sites in Morogoro Rural District.

were almost 34% more live timber trees, 45% more live poles, and > 55% more withies recorded in joint forest management areas, and lower incidences of freshly cut poles and withies. Other forms of forest disturbance in joint and non-joint forest management plots are shown in Fig. 5. Incidence of fire is six times higher, and incidence of traps, charcoal pits, signs of active farming, small scale mining, and the harvesting of trees for tools are higher in non-joint management plots. Whereas the frequency of old pit-sawing sites and pole cutting was higher in joint than non-joint forest management plots, the incidence of new pit-sawing

sites and pole cutting was lower in the former. Only debarking for medicinal purposes and incidence of grazing appear to be higher in joint forest management plots.

*Forty-nine forests under joint and non-joint management*  
Across the broader sample of 49 Eastern Arc Mountain and lowland coastal forests there are also clear trends in forest condition. Comparing non-joint management sites with forests where joint management has been implemented for increasing numbers of years shows overall declines over time in rates of pole and timber harvesting in the combined

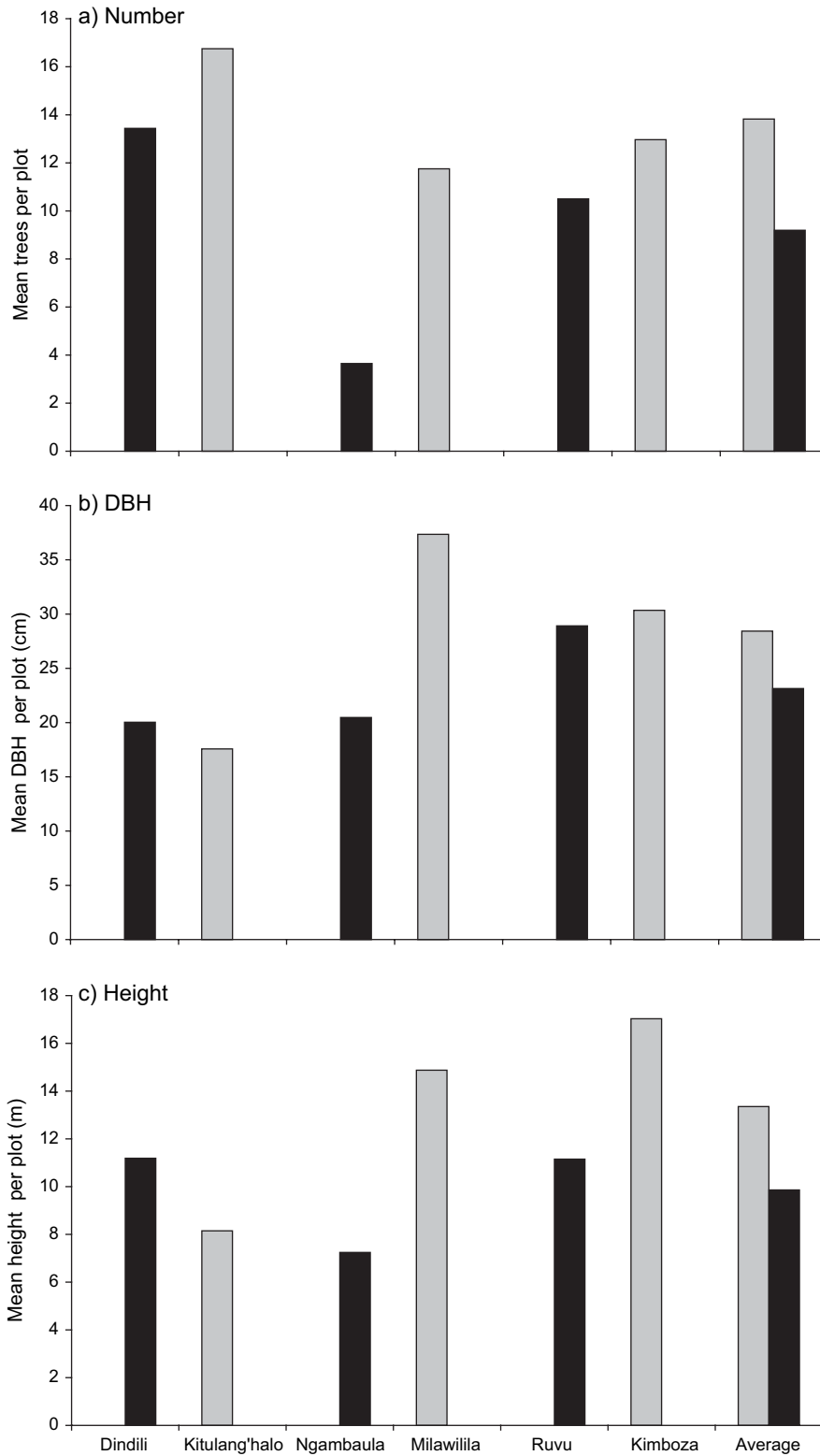


FIG. 4 Mean (a) number of trees, (b) DBH of standing trees, and (c) height of standing trees per plot for paired comparisons of joint (grey) and non-joint forest management (black) sites around the Uluguru Mountains.

Eastern Arc and coastal forest sites (Fig. 6). After 10 years of joint forest management implementation there is a dramatic decline in rates of cutting. Applying statistical tests to these data is problematic because of the small sample sizes in some classes (Fig. 6) but regression analysis shows de-

clining trends in cutting over time. Whereas time since the implementation of joint forest management is an important (but not significant) variable in explaining the variation in poles ( $\beta = -0.46$ ,  $P = 0.25$ ,  $R^2 = 0.21$ ), timber ( $\beta = -0.58$ ,  $P = 0.14$ ,  $R^2 = 0.33$ ) and overall cutting ( $\beta = -0.51$ ,  $P = 0.2$ ,



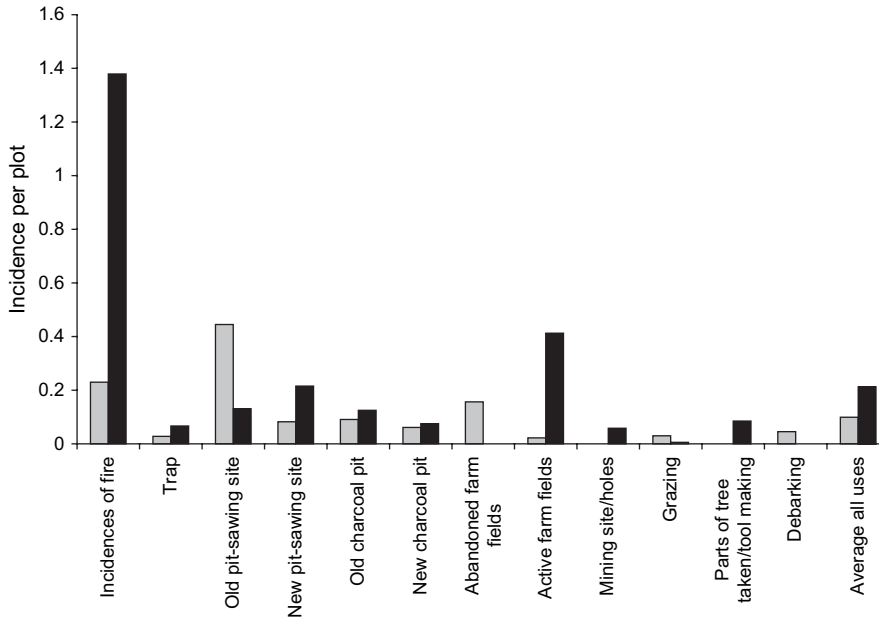


FIG. 5 Incidences per 50 × 10 m plot of disturbance and human use within joint (grey) and non-joint forest management (black) sites around the Uluguru Mountains.

$R^2 = 0.26$ ) in the coastal forests, correlations are even lower in the Eastern Arc Mountains ( $R^2 < 0.1$  in all analyses).

**Discussion**

The national assessment of participatory forest management shows that its spread across the country, whilst

having increased rapidly, is far from even. Given that this approach is primarily defined by central government as a strategy for sustainable forest management, it is perhaps not surprising that many of the resources directed towards it have been targeted at the forest resources with the highest national values, at least from biodiversity and water catchment perspectives. The Eastern Arc forests feature

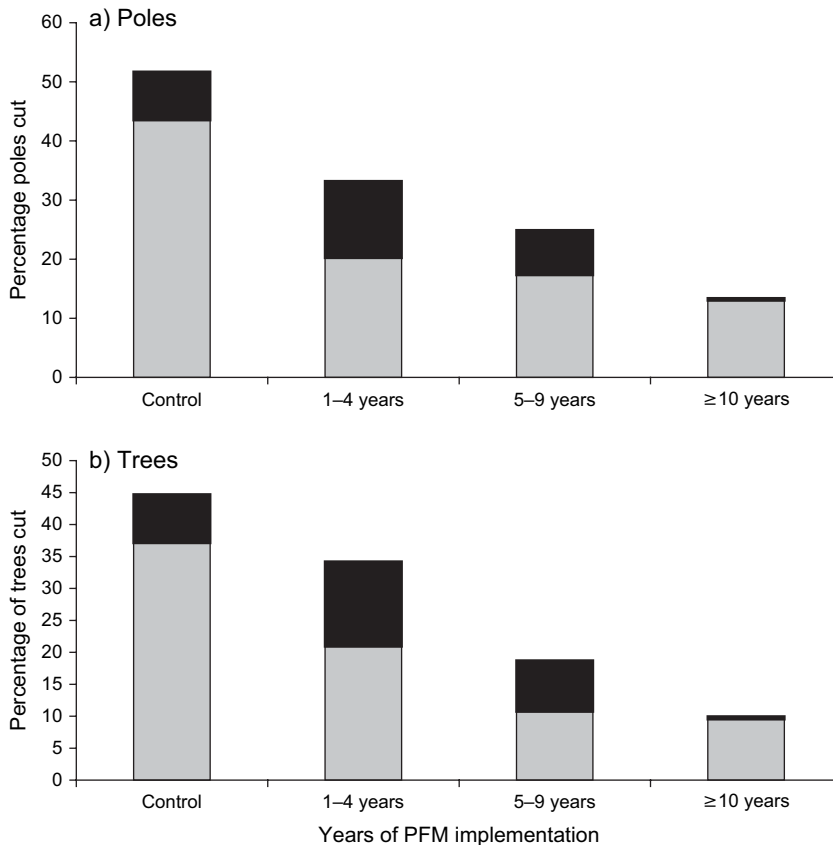


FIG. 6 Percentage cutting of (a) poles and (b) trees within seven coastal forests (grey portion of bars) and 42 Eastern Arc mountain forests (black portions) under non-joint forest management (control) and under increasing numbers of years of implementing participatory forest management (PFM). Control based on data from 23 Eastern Arc and two coastal forests managed by the State. Implementation of participatory forest management arrangements between the State and communities for 1–5 years duration based on data from eight Eastern Arc and one coastal forest; implementation for 6–9 years based on data from nine Eastern Arc and one coastal forest; implementation for ≥ 10 years based on data from one Eastern Arc and four coastal forests.

heavily in the list of sites where participatory forest management (primarily joint forest management) has been implemented, as do the lowland coastal forests and mangroves along the coastal strip. Less effort has been put into establishing participatory forest management in forests and woodlands with lower biodiversity values but with a higher utilization potential for local communities. The more recent expansion of participatory forest management into miombo and *Acacia* woodland habitats may have been because of the increased emphasis placed by both the government of Tanzania and its development partners on poverty reduction objectives (Blomley & Ramadhani, 2006) but may also be due to concerns being voiced about the lack of community benefits in some of the existing joint forest management schemes in the Eastern Arc Mountain forests (Meshack *et al.*, 2006; Pfliegner & Moshi, 2007).

All three of our case studies indicate that participatory forest management appears to be contributing to sustainable forest management. A range of variables, such as increases in basal area, mean annual growth rates, levels of harvesting, presence of trees used for timber and poles, and recorded incidences of forest disturbance through human activity, all point to this conclusion. This contrasts with measurements taken on land administered solely by government agencies with no community involvement, or on village land under open access arrangements, where forest condition is typically declining.

Joint forest management in the coastal forest and Eastern Arc habitats appears to have become more effective over time, especially in the coastal forests. This is perhaps not surprising as it takes a number of years for such management regimes to be established and further time for any impacts to be seen in forest condition. The lower impact in the Eastern Arc may be related to the fact that the forests there are generally in better condition, and hence there is less scope for improvement.

The data presented in Fig. 2 suggest there is increased volume and basal areas under joint compared to community-based management. In addition, the data show clear indications of reduced disturbance and improved forest condition under joint forest management when compared to state or open access regimes. While we urge caution when disaggregating these data (as the sample was small and growth rates between forests will vary independently of management regime because of local climatic conditions), they do pose some interesting questions that merit further discussion. Joint forest management in Tanzania has been strongly criticized because of its failure to deliver tangible benefits to forest dependent communities and its inherent inequity in terms of how forest management costs and benefits are distributed between the state and forest users (Blomley & Ramadhani, 2006; Lund & Nielsen, 2006; Meshack *et al.*, 2006; Pfliegner & Moshi, 2007).

Joint forest management, it has been argued, is a strategy that allows government to shed its responsibilities in forest

management by co-opting communities for minimal tangible returns, as the legal status of so-called protection forests severely restricts local use beyond a few non-timber forest products such as medicinal plants, thatching grass and honey. Common-pool resource theory stipulates that for community-based management of natural resources to be viable in the long term, a group must feel that the benefits gained from collective action must outweigh the costs (Ostrom, 1999; Poteete & Ostrom, 2002), expressed here in terms of transaction cost of establishing joint forest management, costs of foregone use, and costs of long-term management and monitoring. Consequently, forests wholly managed and owned by communities (under community-based management) with the potential to generate considerable local economic returns, would be expected to provide greater incentives for sustainable management than those managed under joint management where incentives and returns are lower. The data we present tend to suggest otherwise: while the benefits enjoyed at household and community level from joint forest management may be minimal, we suggest it has played, and continues to play, an important role in the conservation of valuable forests. Similarly, our data suggest that joint forest management is far from being non-viable in the long term, rather it appears to be more effective over time (Fig. 6). This raises an important further question: why, after a number of years, are communities continuing to undertake active management in forests that are delivering little to them in terms of tangible benefits? One possible explanation is the reported tendency towards so-called elite capture in joint forest management arrangements, reported in Tanzania and further afield (Kumar, 2002; Adhikari *et al.*, 2006; Blomley, 2006; Meshack *et al.*, 2006; Pfliegner & Moshi, 2007).

Poor facilitation of participatory forest management planning and establishment processes can result in a small group of villagers (typically the Village Natural Resource Committee or other village leaders) capturing and retaining benefits to the detriment of others. The same leaders ensure that the monopoly over benefit flows (such as illegal charcoal or timber harvesting) are maintained through limited patrols and exclusion of other potential competitors. This phenomenon may be particularly acute when the total flow of local forest benefits is limited. By concentrating these benefits within a small group of people, incentives may become sufficient to maintain active management. Although inequitable, and of questionable sustainability, it is likely that the level of forest protection offered under such an arrangement may be greater than under exclusive state management or open access regimes. For confirmation of this more research is required at a variety of sites.

Our findings are supported by other studies undertaken in Tanzania that have sought to assess the effectiveness of traditional Forest Reserves (managed by customary

traditional institutions) on improving forest condition, compared with state managed forest reserves. Mgumia & Oba (2003) established that although traditional Forest Reserves in Tabora Region were relatively small in size, they had a greater woody species richness and taxonomic diversity than a neighbouring state-managed Forest Reserve with comparable ecological conditions. Similarly, Mwihomeke *et al.* (1998) estimated that >7,000 ha of montane forest in 1,740 sites (locally known as *mshitu*) in North Pare mountains and Handeni districts were being managed through the application of traditional management practices for the protection of sacred forests. A third study from Shinyanga region documents the impact of establishing *ngitili*, a traditional system of reserving pasture lands and dry season grazing areas by Sukuma pastoralists, which results in a rapid regeneration of trees (Monela *et al.*, 2005). The study was able to document the re-establishment of a total of 152 different trees, shrub and climber species within *ngitili*, as well as of 145 bird and 21 mammal species. This contrasted with a general decline of forest condition in areas outside established *ngitili*.

We have not attempted to present any findings regarding the degree to which participatory forest management addresses its two other stated policy objectives, namely improved livelihoods and improved forest governance at village and district levels. This is partly because of the fact that it was beyond the scope of this study but also because available data on these issues are limited. This highlights the need for further research to be focused on assessment of whether and under which conditions participatory forest management can contribute to all of its three stated objectives of improved forest condition, livelihoods and forest governance at local levels. Such a study has recently been launched by the Tanzania Forestry Research Institute through a partnership between the Sokoine University of Agriculture and a consortium of international research bodies (including the Universities of Copenhagen, Cambridge and Manchester).

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### References

- ADHIKARI, B., DI FALCO, S. & LOVETT, J.C. (2004) Household characteristics and forest dependency: evidence from common property forest management in Nepal. *Ecological Economics*, 48, 245–257.
- AHREND, A. (2005) *Patterns of degradation in lowland coastal forests of Coast Region, Tanzania*. Diploma thesis, University of Greifswald, Greifswald, Germany.
- AKIDA, A. & BLOMLEY, R. (2006) *Trends in Forest Ownership, Forest Resources Tenure and Institutional Arrangements: Are They Contributing to Better Forest Management and Poverty Reduction? Case Study from Tanzania*. Unpublished Report. FAO, Rome, Italy.
- BLOMLEY, T. (2006) *Mainstreaming Participatory Forestry Within the Local Government Reform Process in Tanzania*. Gatekeeper Series No. 128. International Institute for Environment and Development, London, UK.
- BLOMLEY, T. & RAMADHANI, H. (2006) Going to scale with Participatory Forest Management: early lessons from Tanzania. *International Forestry Review*, 8, 93–100.
- BURGESS, N.D., BUTYNSKI, T.M., CORDEIRO, N.J., DOGGART, N., FJELDSÄ, J., HOWELL, K. *et al.* (2007) The biological importance of the Eastern Arc mountains of Tanzania and Kenya. *Biological Conservation*, 134, 209–231.
- BURGESS, N.D. & CLARKE, G.P. (eds) (2000) *The Coastal Forests of Eastern Africa*. IUCN Forest Conservation Programme, Gland, Switzerland, and Cambridge, UK.
- BURGESS, N.D., DOGGART, N. & LOVETT, J.G. (2002) The Uluguru Mountains of eastern Tanzania: the effect of forest loss on biodiversity. *Oryx*, 36, 140–152.
- DE VAUS, D. (2002) *Surveys in Social Research, 5th Edition*. Routledge, London, UK.
- FRONTIER TANZANIA (2001) *Udzungwa Mountains Biodiversity Surveys – Methods Manual* (eds K.Z. Doody, K.M. Howell & E. Fanning). Unpublished Report for the Udzungwa Mountains Forest Management and Biodiversity Conservation Project, Iringa, Tanzania.

- ISANGO, J.A. (2006) *Monitoring Growth and Impact of Harvesting Options, Shifting Cultivation and Grazing on Vegetation Growth in Miombo Woodlands of Iringa District, Tanzania*. Unpublished Report. Tanzania Forestry Research Institute, Morogoro, Tanzania.
- ISANGO, J.A. (2007) *Monitoring of Permanent Sample Plots (PSPs) established in SULEDO Miombo Forests in Kiteto Districts, Tanzania*. Unpublished Report. Tanzania Forestry Research Institute, Morogoro, Tanzania.
- KAJEMBE, G.C., NDUWAMUNGU, J. & LUOGA, E.J. (2006) *The Impact of Community Based Forest Management and Joint Forest Management on the Forest Resource Base and Local Peoples' Livelihoods. Case Studies from Tanzania*. Commons Southern Africa Occasional Series No. 8. Centre for Applied Social Sciences, University of Harare, Zimbabwe.
- KUMAR, S. (2002) Does "Participation" in Common Pool Resource Management help the poor? A social cost-benefit analysis of Joint Forest Management in Jharkhand, India. *World Development*, 30, 763–782.
- LOVETT, J.C. & WASSER, S.K. (eds) (1993) *Biogeography and Ecology of the Rain Forests of Eastern Africa*. Cambridge University Press, Cambridge, UK.
- LUND, J.F. & NIELSEN, Ø.J. (2006) The promises of Participatory Forest Management in forest conservation and poverty alleviation: the case of Tanzania. In *L'Afrique Orientale. Annuaire 2005* (eds H. Charton & C. Médard), pp. 201–241. L'Harmattan, Paris, France.
- LUOGA, E.J., KAJEMBE, G.C. & MOHAMED, B.S. (2003) *Impact of Joint Forest Management on Handeni Hill Forest Reserve and Adjacent Communities in Tanga, Tanzania*. Unpublished Report. Sokoine University of Agriculture, Morogoro, Tanzania.
- MALIMBWI, R.E., ZAHABU, E., MISANA, S., MONELA, G.C., JAMBIYA, G.C. & MCHOME, B. (2005) Charcoal potential of miombo woodlands at Kitulungalo, Tanzania. *Journal of Tropical Forest Science*, 18, 121–126.
- MESHACK, C.K., AHDIKARI, B., DOGGART, N. & LOVETT, J.C. (2006) Transaction costs of community-based forest management: empirical evidence from Tanzania. *African Journal of Ecology*, 44, 468–477.
- MGUMIA, F.H. & OBA, G. (2003) Potential role of sacred groves in biodiversity conservation in Tanzania. *Environmental Conservation*, 30, 259–265.
- MONELA, G.C., CHAMSHAMA, S.O., MWAIPOPO, R. & GAMASSA, D.M. (2005) *A Study on the Social, Economic and Environmental Impacts of Forest Landscape Restoration in Shinyanga Region, Tanzania*. Unpublished Report. The World Conservation Union Eastern Africa Regional Office, Nairobi, Kenya.
- MWIHOMEKE, S.T., MSANGI, T.H., MABULA, C.K., YLHÄISI, J. & MNDEME, K.H. (1998) Traditionally protected forests and nature conservation in the North Pare Mountains and Handeni District, Tanzania. *Journal of East African Natural History*, 87, 1–28.
- OSTROM, E. (1999) *Self Governance and Forest Resources*. Occasional Paper No. 20. Centre for International Forestry Research, Bogor, Indonesia.
- PFLIEGNER, K. & MOSHI, E. (2007) Is Joint Forest Management viable in protection forest reserves? Experiences from Morogoro Region. *The Arc Journal*, 21, 17–20.
- PLUMPTRE, A.J., DAVENPORT, T.R.B., BEHANGANA, M., KITYO, R., EILU, G., SSEGAWA, P. *et al.* (2007) The biodiversity of the Albertine Rift. *Biological Conservation*, 134, 178–194.
- POTEETE, A. & OSTROM, E. (2002) *An Institutional Approach to the Study of Forest Resources*. International Forestry Resources and Institutions Research Program, Indiana University, Bloomington, USA.
- SEMESI, A.K. (1992) Developing management plans for mangrove forest reserves of mainland Tanzania. *Hydrobiologia*, 247, 1–10.
- URT (UNITED REPUBLIC OF TANZANIA) (1998) *National Forest Policy*. Ministry of Natural Resources and Tourism, Forestry and Beekeeping Division, Dar es Salaam, Tanzania.
- URT (UNITED REPUBLIC OF TANZANIA) (1999) *Village Land Act (and Regulations) No. 5 of 1999*. Ministry of Lands and Human Settlements, Dar es Salaam, Tanzania.
- URT (UNITED REPUBLIC OF TANZANIA) (2001) *Project Implementation Manual: Annex 2. Improving Service Delivery for Participatory Forest Management*. Unpublished Report. Ministry of Natural Resources and Tourism, Forestry and Beekeeping Division, Dar es Salaam, Tanzania.
- URT (UNITED REPUBLIC OF TANZANIA) (2002) *The Forest Act, No. 7 of 7th June 2002*. Ministry of Natural Resources and Tourism, Dar es Salaam, Tanzania.
- URT (UNITED REPUBLIC OF TANZANIA) (2003) *Framework for Participatory Forest Management*. Ministry of Natural Resources and Tourism, Dar es Salaam, Tanzania.
- URT (UNITED REPUBLIC OF TANZANIA) (2006) *Participatory Forest Management: Facts and Figures*. Ministry of Natural Resources and Tourism, Forestry and Beekeeping Division, Dar es Salaam, Tanzania.
- WHITE, F. (1983) *The Vegetation of Africa. A Descriptive Memoir to Accompany the UNESCO/AETFAT/UNSO Vegetation Map of Africa*. UNESCO, Paris, France.
- WILY, L. (1998) *Villagers as Forest Managers and Governments "Learning to Let Go". The Case of Duru Haitemba and Mgori Forests in Tanzania*. Forest Participation Series No. 9. International Institute for Environment and Development, London, UK.
- WILY, L.A. (2000) Forest law in eastern and southern Africa. Moving towards a community based forest future? *Unasylva*, 203, 29–62.
- WILY, L.A. (2002) Participatory forestry in Africa: an overview of progress and issues. In *Second International Workshop on Participatory Forestry in Africa: Defining the Way Forward: Sustainable Livelihoods and Sustainable Forest Management through Participatory Forestry*, pp. 31–58. Proceedings of the Second International Workshop on Participatory Forestry in Africa 18–22 February 2002. FAO, Rome, Italy.
- ZAHABU, E. (2006a) Case Study 2. Handei Village Forest Reserve, Tanzania. In *Community Forest Management as a Carbon Mitigation Option. Case Studies* (eds D. Murdiyarso & M. Skutsch), pp. 16–20. CIFOR, Bogor, Indonesia.
- ZAHABU, E. (2006b) Case Study 3. Kitulungalo Forest Area, Tanzania. In *Community Forest Management as a Carbon Mitigation Option. Case Studies* (eds D. Murdiyarso & M. Skutsch), pp. 21–26. CIFOR, Bogor, Indonesia.

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