

Seeing White Elephants? The Production and Communication of Information in a Locally-based Monitoring System in Tanzania

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Abstract

The literature on locally-based monitoring in the context of conservation displays a great deal of optimism about the prospects of involving local people in the systematic gathering of information about the condition and use of natural resources and conservation areas to inform management decisions from local to national levels. This study challenges this notion based on a case study of a collaborative forest management and locally-based monitoring project that has been considered a successful showcase example in Tanzania. It does so by comparing information from locally-based monitoring of forest condition and financial transactions, as presented by community management institutions to higher authorities, with forest transect surveys and an audit of financial accounts. The results reveal that the information produced and communicated under the locally-based monitoring system contradicts trends in wildlife densities and human disturbance observed in the forest and under-represents actual financial flows. Interviews and observations further indicate that communication of this information takes place under conditions of ongoing power struggles over access to benefits of collaborative forest management. This study serves to caution that the information produced and communicated under the locally-based monitoring system may be shaped by the incentives and power struggles surrounding the particular context within which the system is based and therefore cannot be taken at face value.

Keywords: locally-based monitoring, collaborative forest management, power, governance, Africa

INTRODUCTION

The assessment of changes in the condition and integrity of ecosystems is a persisting challenge in the planning and implementation of initiatives for their conservation and management (Stem et al. 2005; Ferraro and Pattanayak 2006). Particularly in relation to developing countries, the cost of continued assessments of the status and development of ecosystems implies that it is unclear whether many reserves and parks exist only on paper (McNeely et al. 1994; Spergel

2002). However, recent literature on locally-based monitoring purports to offer a solution to this conundrum. It is argued that by involving people living in rural areas in the systematic gathering of information about natural resources and their use, information can be generated to support management decisions from local to national levels (Danielsen et al. 2000, 2005). Further, it is envisaged that such monitoring can be effective in a variety of management regimes and scales ranging from national protected areas to natural resources managed by local communities (Danielsen et al. 2009). Along similar lines, locally-based monitoring has been suggested as a means to monitor, report and validate compliance in relation to forest degradation in reduced emissions from deforestation and forest degradation (REDD+) schemes to the extent that carbon payments could be based on inventories made by communities managing local forests (Skutsch et al. 2009; Danielsen et al. 2011; Fry 2011). In a recent paper, Garcia and Lescuyer (2008) further argue that local monitoring systems are best suited to situations where national authorities and local communities

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collaborate on resource management, and that “the monitoring system then offers the possibility to assess whether the terms of the contract are being respected on both sides—the state and the local stakeholders.” Thus, it is envisaged that locally-based monitoring systems can generate information that can be used to assess whether the development in the natural resource or ecosystem condition fulfils the standards set by a contract specifying local management rights and responsibilities over natural resources management. Earlier, Danielsen et al. (2003) have expressed the same sentiment stating “It seems that integrating scientific and participatory biodiversity monitoring techniques have particular potential in areas where authorities embark on shared management of resources with local people, and authorities and locals have common interest in the management objectives [...]” It appears reasonable to say that the locally-based monitoring literature, as represented by these studies, assumes that the interests of national (and sub-national) authorities and local communities can be joined in a common effort to monitor, conserve and manage natural resources. This, to a degree where members of local communities willingly produce and surrender to higher authorities information about the status and development of natural resources—information that can potentially be used to revoke their management, use and taxation rights (e.g., Ribot et al. 2006; Larson and Ribot 2007).

This picture, however, resonates poorly with another body of literature concerned with devolution or sharing of management rights and responsibilities over natural resources and ecosystems between states and local communities. In broad terms, this literature suggests that sharing of management rights and responsibilities is contested and characterised by ongoing power struggles—locally, within communities, as well as between communities and the state (Roe et al. 2009; Ribot et al. 2010; Funder et al. Unpublished). Communities are heterogeneous entities comprising a multiplicity of actors and interests (Agrawal and Gibson 1999), and numerous studies have demonstrated that internal power struggles over resources and elite capture of natural resource management processes are the rule rather than the exception (Kumar 2002; Adhikari et al. 2004; Schreckenber and Luttrell 2009; Balooni et al. 2010). Similarly, there is no shortage of research demonstrating that the relations between the state and communities in relation to sharing of rights over (forest) resources are as much characterised by contestation as cooperation (Ribot et al. 2006; Benjamin 2008; Mustalahti and Lund 2010). In Tanzania, as elsewhere, there are longstanding tensions between local communities and state conservation objectives related to relocation and land rights issues (Igoe and Brockington 1999; Igoe 2004; Sachedina 2008; Goldman 2009). And despite the move towards community-based conservation, communities are still seen more as tools to be harnessed and trained rather than actual and knowledgeable partners or even beneficiaries (Goldman 2003). Conservation agendas and arguments are in turn politicised, resisted and transformed at the local level, resulting in unpredicted pre-emptive actions with potential negative implications for conservation (Goldman 2009).

Important to our argument are examples of claims supported or contested by Tanzanian communities by making references to information (or lack thereof) about the state of the resource (e.g., Mustalahti and Lund 2010; Funder et al. Unpublished). It thus appears reasonable to hypothesise that the information produced and communicated in locally-based monitoring systems is subjective to the strategic interests of those responsible for production of the information in the specific social and political context in which the systems operate. Little empirical evidence is, however, available on this issue in relation to locally-based monitoring.

Several recent studies on locally-based monitoring pay only scant attention to the above mentioned issues by evaluating how locally-based monitoring is produced and communicated in isolation from the local political reality (i.e., in an experimental setup). Riest et al. (2010), for example, found a strong correlation between results from locally-based monitoring and scientific surveys on catch, effort and spatial distribution of bushmeat hunting. This study was, however, conducted in a context very different from the reality in most conservation areas in developing countries, as hunting was legal, the people doing the monitoring were directly paid by the researchers, and the data were not meant to result in any management interventions and thus posed no implications for local livelihoods. In comparison, Yasué et al. (2010) found that community members perceived a considerable increase in fish stocks inside and catch outside a community managed marine protected area, whereas biological surveys showed a high degree of stochastic variation and only a minor increase in fish abundance. The authors argued that the observed discrepancy could be explained by community members’ wishful thinking, desire to please external actors, or confounding with other benefits of the project.

With this paper, we seek to illustrate how the information produced and communicated by locally-based monitoring systems should be understood in the social context within which they operate. We do this through a case study of the production and communication of information about forests and their management under a highly standardised locally-based monitoring system set up as a component of a donor supported collaborative forest management project in Tanzania. We thus distinguish sharply between the production and communication of highly standardised information in this locally-based monitoring system and knowledge as it exists in traditional ecological knowledge systems etc., with which this paper is not concerned. Furthermore, we do not propose that community members trained to systematically collect, record and communicate information about natural resources and their management—which is what this locally-based monitoring system inherently is about—will do better or worse than scientists. Rather, our paper specifically concerns the way that the conditions under which this information is produced and communicated is important for understanding and interpreting it. This contribution should thus be seen as a cautionary comment to the optimism displayed in the locally-based monitoring literature (see above) and as a

small, empirical contribution to the larger literature on the co-production of knowledge and social order (e.g., Jasanoff 1996; Forsyth 2008).

We investigate the production and communication of locally-based monitoring information on indicators of forest disturbance, wildlife densities and financial transactions by Village Natural Resource Councils (VNRCs) in eight villages to the District Land and Natural Resource Office (DLNRO) in monthly reports over five years. The reported information is compared to information on the same indicators collected by us through an audit of VNRC receipts and vouchers and by conducting forest transect surveys. The purpose of this comparison is to provide an empirical background for a discussion of the social context within which the information is produced and communicated with a particular emphasis on power struggles in relation to access to the benefits associated with collaborative forest management.

STUDY AREA

The study was conducted in eight villages in Iringa district, Tanzania, where the Danida supported MEMA (Sustainable Use of Natural Resources) projects implemented collaborative forest management from 1999 to 2004 in the Udzungwa mountains and adjacent woodlands. The forests of the Udzungwa mountains hold considerable national and international conservation interests as a source of water and a component of the Eastern Afromontane biodiversity hotspot (Mittermeier et al. 2004). The primary management concern in the Udzungwa mountains is unregulated bushmeat hunting by local communities (Nielsen 2006; Topp-Jørgensen et al. 2009). The woodland (miombo) forests are of limited biodiversity conservation value but supply the surrounding communities and Iringa town with numerous forest products, including firewood, charcoal, construction materials and various non-timber forest products (NTFPs) (Kessy and Mbeyale 2001). The main management concerns here are overexploitation of timber, and firewood, charcoal making and forest encroachment (Lund and Treue 2008).

The Government of Tanzania has, through revisions of forest policy and legislation, created a favourable environment for collaborative forest management (Wiley 2001; Wiley and Dewees 2001). Two types of management are pursued depending on the legal status of the forest. Joint Forest Management (JFM) is established through formal collaborative management agreements between the state and communities, specifying rights and responsibilities in managing national and local authority forest reserves. JFM, which has been implemented in the forest of the Udzungwa mountains, does not involve complete transfer of jurisdiction, and access to forest resources is restricted (primarily honey, medicine plants, bark and forest vegetables may be collected) in consideration of national priorities in relation to the areas' catchment value and global conservation importance. Community-based Forest Management (CBFM) has primarily been implemented in the woodland areas and provides villages with full ownership and

management responsibilities, as well as the right to harvest forest products.

The MEMA projects provided support for awareness campaigns, forest boundary demarcation and formulation of management plans, and facilitated the election of VNRCs by village general assemblies. Management agreements were officially enacted in February 2002 and management rights and responsibilities have been vested in management plans and village by-laws. The VNRC has executive power to plan and perform forest management operations such as patrols, fire control, tree planting and arresting offenders, as well as rights to issue permits and collect fees for natural resource use and fines in accordance with management plans. Four patrol guards elected alongside and operating under the auspices of the VNRC are responsible for patrolling the forest at least once a week. Wildlife is not included in the management plan, and utilisation requires a permit from the district wildlife authorities in accordance with Tanzania's Wildlife Policy (URT 1998). However, while not allowed to utilise or collect any revenue from wildlife, VNRCs are required to enforce hunting regulations (Topp-Jørgensen et al. 2005). JFM villages retain all revenue collected from fines, permits, etc., whereas CBFM villages hand over five per cent of the revenue to the Iringa DLNRO. The retained revenue may be used to finance administrative and management costs of the VNRC, while all remaining funds must be used for public services.

The patrolling and records of the VNRC form the basis of a comprehensive locally-based monitoring system that was developed and implemented by external consultants in 2002–2003 (Topp-Jørgensen et al. 2005). The system was designed and implemented with the primary aim to ensure collection and communication of information on forest condition and disturbances, as well as financial transactions that would facilitate discussion on resource and financial trends in the VNRCs and the wider community, upon which informed management decisions could be based (Danielsen et al. 2000; Topp-Jørgensen et al. 2005). The system also facilitates evaluation of VNRC performance not only by villagers, but also by higher authorities. The VNRCs are thus required to prepare and submit monthly reports on their ecological monitoring and financial transactions to the village council and DLNRO. All VNRCs have been issued receipt, voucher and permit books with serial numbers that are used to record all transactions and permits issued. Patrol guards are required to record resource use, illegal activities and observations (spoor or actual observations) of wildlife species (selected depending on location) in standardised patrol forms (specific for the montane vs. woodland/miombo area). Patrol guards also record the effective duration of the patrols by recording the start and finish time at the forest edge (as well as time spent on lunch break, etc.). Based on these patrol forms and the permits, receipts and vouchers, VNRCs produce a monthly monitoring report that, in addition to summarising income, expenditure, permits issued, number of and time spent on patrols, observations of each species and type of resource use or disturbance, also includes information from interviews

with users on their perception of resource trends, information on VNRC meetings, activities and training sessions and VNRC management suggestions and actions. VNRCs can also write an overall conclusion on their progress in relation to management objectives and questions or requests for help in the monthly reports that are submitted to the DLNRO [see Topp-Jørgensen et al. (2005) for a full description]. Transparency and accountability is, in theory, ensured by a number of requirements, including: direct elections for VNRCs every five years; formal approval of monthly reports through the signature of the village chairman; deposit of VNRC revenue in a bank account (jointly for a zonal committee for villages surrounding the same forest in the montane area); presentation of a summary of financial transactions by the VNRCs at quarterly village meetings; and making VNRC records available for all community members to see. The DLNRO is envisaged to support the communities in management, but also has a control function in relation to the objectives of the management plan, which includes the ability to recommend to the Director of the Forestry and Beekeeping Division under the Ministry of Natural Resources and Tourism that the villages' management rights be revoked. The monitoring system has been classified as collaborative monitoring with local data interpretation in a characterisation of monitoring approaches (Danielsen et al. 2009).

Table 1 provides an overview of the four JFM and four CBFM villages included in this case study. The villages represent a sample of the 23 villages under the MEMA projects, selected to provide variation in socio-economic characteristics as well as variation in the degree to which the villages have received attention from the DLNRO, researchers, consultants, tourists and others. To protect the identities of the people involved, the real names of the villages are not reported.

METHODS

Collected data consist of copies of all existing monthly reports, meeting minutes, receipts and vouchers from the period January 2003 to July 2008 obtained from the VNRCs or the

DLNRO. Transect surveys were conducted in the forests in the montane JFM area to enable a comparison with the trends in the ecological information communicated through the locally-based monitoring system. This comparison is justified by the highly standardised nature of the locally-based monitoring system, the procedures of which are comparable to transect surveys targeting indicators of wildlife densities and human disturbances. It was not possible to collect data that would allow a similar comparison in the woodland CBFM area. Semi-structured interviews were conducted with the VNRC and patrol guards in each village as well as with officers at the DLNRO, in order to understand the processes of production and communication of information in the locally-based monitoring system. Finally, information and observations on ongoing power struggles between various actors during our field work in the area were recorded. In total, the fieldwork was based on more than 25 months spent in and around these villages over the past seven years by the authors.

The comparison of trends in ecological information focused on observations of dung piles from the following wildlife species: blue duiker (*Cephalophus monticola*); Harvey's duiker (*C. harveyi*); Abbott's duiker (*C. spadix*); eastern tree hyrax (*Dendrohyrax validus*); bush pig (*Potamochoerus larvatus*); and African buffalo (*Syncerus caffer*) in the montane area since actual sightings of these animals are rare. The duikers and eastern tree hyrax are forest dependent species, whereas bush pig and buffalo also roam outside the forest (Kingdon 2003). Whether this follows a seasonal pattern is not clear, but given that any local migratory pattern would be repeated annually, it should have no implications for villagers' interpretation of trends over several years. Only number of active traps was considered as a measure of human disturbance. To facilitate presentation of trends in observations of dung piles and traps reported in monthly reports, trend lines were constructed through linear regression of the average annual number of observations per hour patrolled by VNRC patrol guards. Transect surveys were based on distance sampling using variable width line transect sampling to estimate relative wildlife densities and disturbance levels from observations

Table 1
Basic characteristics of the eight case study villages

	Joint Forest Management	Community-based Forest Management
Village names	Moja, Mbili, Tatu and Nne	Tano, Sita, Saba and Nane
Population (per village)	1,000–2,600	1,600–3,000
Distance to Iringa town (km)	45–80	20–60
Rainfall (mm/year)	1,500–2,000	600–900
Growing seasons	2	1
Main agricultural crops	Maize, beans, potatoes, green peas, various vegetables, tea, fruit trees	Maize, sunflower, beans, tobacco, millet, tomato, ground nut
Forest data		
Habitat type	Montane to upper montane forest	Dry miombo woodland forest
Forest area (ha)	3,700–35,000	5,000–10,000
Forest elevation (msl)	350–2,570	1,200–1,600
Standing stock (cu. m/ha)	NA	45–70
Main forest uses	Bushmeat hunting, pole cutting, medicine plant collection	Firewood for tobacco curing and selling, charcoal, grazing, timber

of dung piles and traps respectively (Burnham et al. 1980). A total of 18.4 km along five transects in New Dabaga Ulongambi Forest Reserve (NDUFR) and 12 km along four transects in West Kilombero Scarp Forest Reserve (WKSFR) (now a component of the Kilombero Nature Reserve) were surveyed in the dry season from July to September in 2001 and 2008 using the same two local assistants [see Nielsen (2011) and Nielsen and Treue (2011) for further details]¹. Observations were truncated at 5 per cent, grouped in appropriate intervals and relative densities were estimated using Distance 5.0 release 2 (Thomas et al. 2006) and the uniform detection function with cosine expansion². For species and disturbances with insufficient observations on individual transects, the detection function and specifications for all transects combined was used to estimate density (Buckland et al. 2001). Only transects adjacent to the case study villages were considered³. The conclusions on trends in wildlife abundance and disturbances written by VNRCs in monthly reports were included in the analysis to support evaluation of how information on the VNRCs' ecological monitoring is communicated through the monthly reports. For the same reason, the VNRCs were interviewed about their perceptions of trends for specific species and types of disturbances over the relevant period of time.

Monthly figures on VNRC income and expenditure were calculated based on information communicated in monthly reports and compared with similar information from receipts and vouchers. Obvious recording mistakes were corrected after discussions with the VNRCs.

Semi-structured interviews with VNRC members and patrol guards focused on assessing their knowledge of monitoring procedures and the perceived relevance of the monitoring system, both of which may affect information produced in locally-based monitoring systems (Sheil 2001; Holck 2007). Finally, narratives describing conflicts within VNRCs and with other actors, including reasons for changes in VNRC membership and known cases of embezzlement, were obtained from current and former VNRC members. All relevant information was triangulated through individual interviews with community members, village governments and officers from the DLNRO, as well as through numerous observations of VNRC meetings, village assemblies and other situations.

RESULTS

Ecological monitoring information

Results of the comparison of trends in wildlife densities are based on: (i) observations by patrol guards as reported by VNRCs in monthly reports; (ii) VNRC interview statements; and (iii) repeated transect surveys (presented in Table 2), as well as written conclusions by VNRCs in monthly reports. Reported observations of wildlife spoor and signs of resource use were highly fluctuating (i.e., low R^2 values) (e.g., in Tatu), and data were missing for entire years from most villages (i.e., Mbili, Moja and Nne), suggesting a lack

of capacity or incentives to patrol and record this aspect in reports. Furthermore, trends are often weak (i.e., numerically small slope coefficient). Reported observations for some species and signs of disturbance are consistent with, or more negative than, trends based on the transect surveys. Other reported observations, however, indicate trends that would be considered positive in relation to management objectives, but which are not supported by changes based on transect surveys. This divergence occurs primarily in relation to active traps that represent the primary management concern in the montane area according to VNRCs and the DLNRO. Three VNRCs report data that show declining trends in traps or no observations of traps at all (i.e., in Nne), which is inconsistent with observations from transect surveys, except for the village of Tatu. Similar discrepancies occur in relation to Abbott's duiker and eastern tree hyrax.

During interviews, VNRCs generally stated that wildlife populations were stable or had increased and that levels of human disturbance had decreased. In several cases, these statements contradict trends based on the data reported in monthly reports as well as results of the transect surveys⁴. Finally, the VNRCs in Mbili and Nne wrote general statements or conclusions in the monthly reports claiming increased animal densities (and improved forest condition), which, for several species, contradict trends based on the data reported in monthly reports and/or the transect surveys⁵.

In short, the comparisons reveal several instances where VNRCs in the montane villages communicated information that was more closely aligned with management objectives than supported by transect surveys or trends based on the data reported in monthly reports. We explore potential explanations for this below.

Financial information

Woodland area

Of the 264 observation months for the four villages in the woodland area in the period from January 1, 2003 to June 30, 2008, 96 monthly reports could not be retrieved. Of these, 27 can be attributed to the period January 2006 to January 2007, during which the DLNRO confiscated VNRC receipt and voucher books in response to a government decree banning all forest exploitation⁶. Accordingly, there are 168 observation months for which both types of evidence exist.

Table 3 presents the total amount of income and expenditure recorded in all available monthly reports, receipts and vouchers from January 2003 to June 2008. With the exception of income in Tano, the total incomes and expenditures reported in available monthly reports are much lower than those recorded in receipts and vouchers. This can be a result either of monthly reports not being produced/having gone missing, or that incomes and expenditures reported in monthly reports differ from those recorded in receipts and vouchers. Table 3 further presents the average monthly difference [(monthly report income/expenditure estimate) — (estimate from monthly sum of receipts/vouchers)] between income and expenditure

Table 2
Comparison of trends reported and stated by VNRCs with results of transect surveys

Village/ Species or disturbance	Monthly reports (obs./hour)		VNRC statement	Transect survey (obs./sq. km)	
	Regression coefficients	R squared	Lickert scale	2001	2008
Moja					
Blue duiker	$y=-7*10^{-5}x+0.14$	$R^2=0.88$	↑	0	134
Harvey's duiker	$y=6*10^{-5}x-0.12$	$R^2=0.71$	↑	147	906
Abbott's duiker	$y=7*10^{-6}x-0.015$	$R^2=0.14$	↑↑	0	0
Bush pig	$y=2*10^{-5}x-0.04$	$R^2=0.07$	↑↑	0	44
Eastern tree hyrax	$y=-8*10^{-5}x+0.17$	$R^2=0.06$	→	0	0
Active traps	$y=-1*10^{-5}x+0.03$	$R^2=0.006$	↓↓	22	133
Mbili					
Blue duiker	$y=-0.0004x+0.72$	$R^2=0.47$	↑↑	827	2,723
Harvey's duiker	$y=-2*10^{-5}x+0.04$	$R^2=0.07$	→	1,431	1,667
Abbott's duiker	$y=-9*10^{-5}x+0.17$	$R^2=0.46$	↑	0	20
Bush pig	$y=0.0004x-0.82$	$R^2=0.55$	↑↑	0	0
Eastern tree hyrax	$y=0.001x-2.0$	$R^2=0.62$		0	67
Active traps	$y=-0.0005x+1.07$	$R^2=0.37$	↓↓	0	44
Tatu					
Blue duiker	$y=-0.002x+0.4$	$R^2=0.11$	↑↑	791 and 1,624	21,354 and 29,582
Harvey's duiker	$y=0.004x-0.84$	$R^2=0.21$	↑↑	254 and 1,200	6,060 and 5,586
Abbott's duiker	$y=-7*10^{-5}x+0.13$	$R^2=0.02$	↑	0 and 0	126 and 864
Bush pig	$y=0.0008x-1.56$	$R^2=0.61$	↑	23 and 0	0 and 93
Eastern tree hyrax	$y=-0.0002x+0.44$	$R^2=0.62$	↑↑	0 and 0	0 and 140
Active traps	$y=-0.0001x+0.29$	$R^2=0.01$	↓↓	1,000 and 93	23 and 0
Nne					
Blue duiker	$y=-2*10^{-5}x+0.05$	$R^2=0.5$	↑	14,291 and 3,571	56,307 and 7,128
Harvey's duiker	$y=-0.0002x+0.31$	$R^2=0.02$	↑↑	17,268 and 4,101	22,928 and 8,295
Abbott's duiker	$y=-0.0006x+1.16$	$R^2=0.21$	→	2,764 and 2,265	1,299 and 3,462
Bush pig	$y=-0.0009x+1.84$	$R^2=0.04$	↑↑	733 and 1,370	153 and 1,191
Eastern tree hyrax	$y=0.0003x-0.69$	$R^2=0.02$	↑↑	586 and 1,955	298 and 408
African buffalo	$y=-0.001x+2.25$	$R^2=0.42$	↑↑	1,372 and 0	677 and 26
Active traps	$y=0$		↓↓	0 and 0	69 and 0

Note: Trend lines were generated through linear regression of observations per hour patrolling to facilitate description of trends in information reported by VNRCs in monthly reports in the period 2003–2008. VNRC statements on perceived trends were assessed on a symmetric five point Lickert scale (↑↑ = large increase, ↑ = increase, → = no change, ↓ = decrease and ↓↓ = large decrease). Results of the transect surveys are based on distance sampling on transects adjacent to the villages conducted in 2001 and 2008. For the villages Tatu and Nne, observations along two equal transects close to the villages are reported.

figures reported in monthly reports and receipt/vouchers for the months where both types of records are available. Hence, the discrepancy is an indication of the difference between figures reported in the two types of records and reveals that the average monthly incomes and expenditures based on receipts and vouchers are generally higher than those reported in monthly reports. The differences are, furthermore, characterised by high variation, which implies that none of the estimates of differences are statistically significantly different from zero. In sum, the differences in the total estimates of incomes and expenditures are a combination of monthly reports not being produced/going missing and differences arising from the calculations of monthly figures based on individual receipts and vouchers. Finally, Table 3 shows the share of total income recorded in receipts that are either accounted for in vouchers or remains with the VNRC as cash or in the bank account at the end of June 2008. The results reveal that, for instance, the VNRC in Sita can only account for roughly half its income, whereas the VNRC in Tano has accounted for almost all its income.

Montane area

Comparison of information reported in monthly reports with that recorded in receipts and vouchers from the montane villages is based on 164 observation months in the four villages in the period from January 2003 to June 2008 for which both types of evidence exist. The results presented in Table 4 reveal considerable differences between the two sources of information in several villages. The incomes recorded in receipts from Mbili, Tatu and Nne are higher than that reported in monthly reports but vice versa in relation to Moja. In relation to expenditures, the amounts reported in vouchers are higher than in monthly reports in all villages. When considering only the months for which both types of records could be found, both income and expenditure are consistently lower in monthly reports. Internal transactions within the zonal committee of the villages surrounding NDUFR and WKSFR may have been recorded less consistently in receipts and vouchers and could therefore explain some of this discrepancy⁷. However, with the exception of Moja, excluding all internal transactions

Table 3
Descriptive statistics of the incomes and expenditures reported in monthly reports and receipts and vouchers from the four woodland villages in the period from January 2003 to June 2008

	Tano (N=66)		Saba (N=23)		Sita (N=46)		Nane (N=37)	
	Income TZS	Expenditure TZS	Income TZS	Expenditure TZS	Income TZS	Expenditure TZS	Income TZS	Expenditure TZS
Total sum from monthly report	12,465,700	7,937,190	875,450	706,762	7,819,500	3,976,195	2,212,550	1,501,425
Total sum from vouchers/receipts	12,275,100	10,910,457	2,393,650	1,498,692	12,930,350	6,246,790	4,752,350	3,232,683
Difference	190,600	-2,973,267	-1,518,200	-791,930	-5,110,850	-2,270,595	-2,539,800	-1,731,258
Average of monthly report less monthly sum of receipt/voucher ¹								
Mean	12,760	-40,835	1,417	-432	-18,616	7,353	-10,468	-5,482
Std. dev.	265,301	129,743	12,235	2,173	112,436	84,574	98,695	58,464
Min	-362,400	-804,000	-30,000	-10,000	-433,600	-345,100	-440,000	-168,100
Max	418,000	43,500	45,000	1,000	410,000	210,000	194,000	174,000
Balance by end of June 2008								
Net income ²		1,364,644		894,958		6,683,560		1,519,667
Bank and cash balance		1,282,360		473,980		525,925		1,131,000
Difference		82,284		420,978		6,157,635		388,667
Difference/total income		1%		18%		48%		8%

¹For months only where both types of records are available, ²Total income recorded in receipts less total expenditures recorded in vouchers

Table 4
Descriptive statistics of the incomes and expenditures reported in monthly reports and receipts and vouchers from the four montane villages in the period from January 2003 to June 2008

	Moja (N=44)		Mbili (N=26)		Tatu (N=44)		Nne (N=50)	
	Income TZS	Expenditure TZS	Income TZS	Expenditure TZS	Income TZS	Expenditure TZS	Income TZS	Expenditure TZS
Total sum from monthly report	655,500	110,000	20,000	5,000	102,700	10,000	2,219,280	131,500
Total sum from vouchers/receipts	587,000	366,600	561,000	196,500	898,680	80,200	2,404,860	246,808
Difference	68,500	-256,600	-541,000	-191,500	-795,980	-70,200	-185,580	-115,308
Average of monthly report less monthly sum of receipt/voucher ¹								
Mean	-1,050	-9,306	-42,563	-27,357	-24,428	-3,343	-13,283	-5,797
Std. dev.	32,579	30,009	54,901	41,660	43,511	11,665	52,107	13,612
Min	-60,000	-89,500	-127,500	-101,500	-170,480	-50,000	-260,000	-49,500
Max	100,000	50,000	9,000	5,000	0	10,000	24,000	10,000
Average of monthly report less monthly sum of receipt/voucher (excluding internal transactions in zonal committee such as transfer of funds from zonal to VNRC and vice versa) ¹								
Mean	11,950	-9,306	-5,375	-23,786	-13,475	-1,667	-13,283	-5,797
Std. dev.	26,884	30,009	10,028	39,300	32,911	7,303	52,107	13,612
Min	-27,500	-89,500	-20,000	-101,500	-150,480	-30,000	-260,000	-49,500
Max	100,000	50,000	9,000	5,000	0	1,000	24,000	10,000

¹For months only where both types of records are available

recorded in receipts and vouchers does not change the direction of the discrepancy. Furthermore, discrepancies appear to be concentrated in discrete time periods. The degree of correspondence between records is, for instance, generally high in Moja except for three distinct periods where discrepancies are concentrated. Records from Nne also generally correspond well, but income amounting to TZS 128,500 is missing in the monthly reports with the major part prior to November 2004. A similar pattern appears with regard to Tatu. In Mbili, an income of TZS 220,500 and expenditure of TZS 196,500 recorded in receipts and

vouchers in the period from January 2003 to May 2004, with another peak late 2008, are not reported in the monthly reports⁸. Conducting a village specific audit of accounts in the montane area is inhibited by the fact that the VNRCs surrounding a forest share a common bank account through a zonal committee. This implies that discrepancies cannot be traced to the village level. However, a comparison of income, expenditure and bank account balance and cash holdings for the zonal committee of NDUFR reveals that 55 per cent of the income is unaccounted for (Nielsen and Treue 2011). In WKSFR, the share of income of the two VNRCs in the zonal

committee accounted for was 82–97 per cent. However, 59 per cent of receipts were missing according to serial numbers (See Nielsen 2011).

From the results stated above, it is clear that information on the financial flows presented in the monthly reports by the VNRCs is fragmented and underestimates the true financial flows and underlying resource utilisation levels. First, a share of the income documented in receipts is not accounted for in vouchers, cash or bank balances. Second, a considerable proportion of the financial flows recorded in receipts and vouchers are not communicated through the monthly reports⁹. Finally, some financial transactions and resource uses are simply not recorded anywhere, as we will demonstrate below.

Issues of capacity and relevance

The underlying logic of the locally-based monitoring setup requires that VNRC members know, understand and strictly follow the highly standardised procedures of the monitoring system. Accordingly, the observed discrepancies could potentially be explained by capacity constraints. Therefore, we evaluated the level of training received by VNRC members and patrol guards and their knowledge about monitoring and patrolling procedures.

During implementation of the monitoring system in 2002–2003, all VNRCs received training on patrolling and on how to record information in the various forms, receipts and vouchers through a number of seminars with two representatives from each village and subsequent follow-up meetings in all villages that, in principle, included all VNRC members (Topp-Jørgensen et al. 2005). VNRCs were furthermore encouraged to discuss trends in the monitoring data in terms of more or fewer observations than the previous month or same month in the previous year, as a basis for informed management decisions at the local level (Topp-Jørgensen et al. 2005). Since 2003, no support has been given specifically to this monitoring system. The ability of current VNRC members therefore depends on the degree to which the initial VNRC members have been replaced and the efficiency of transfer of knowledge between old and new VNRC members. In 2008, all eight VNRCs contained at least one, and often several, members that had served on the very first committee. Members of all VNRCs had, in addition, received training during 2006 in relation to a new national monitoring system—NAFOBEDA (National Forestry and Beekeeping Database).

Interviews on monitoring procedures indicated high levels of knowledge among both VNRC members and patrol guards. Patrol guards emphasised starting and stopping the clock at the forest edge to ensure appropriate measurement of effort, which supports the use of observations per hour patrolled as a measure of trends¹⁰. All VNRCs reported summarising data from patrol forms and from receipts and vouchers in accordance with procedures for preparing monthly reports. Records were, however, often found in a pile on the floor in the corner of the village office, indicating that lack of capacity

and/or incentives to store records may limit their completeness. While all VNRCs in the woodland area reported discussing ecological monitoring data during meetings, only the VNRC in Mbili did so in the montane area which may reflect the restrictions on resource use in JFM and associated limited interests of the VNRC in ensuring long term sustainability. However, none of the VNRCs actually compared information across months or years to assess trends. This may explain the discrepancy between trends in ecological information based on monthly reports and that stated during interviews or written in conclusions in the reports. It does not, however, explain the differences of either in relation to the transect surveys.

In addition to knowledge and ability, the perceived relevance of the monitoring data by VNRCs, as indicated above, can affect the production of monitoring information. When interviewed, VNRCs generally stated that all aspects of the monitoring system were highly relevant for their management and they possessed a clear understanding of the purpose and use of each aspect. The fact that montane VNRCs generally did not discuss ecological monitoring data and that no VNRC actively compared monitoring data across years, however, indicates that the VNRCs are not applying the logic of scientific standardised monitoring systems and that they rely on other forms of knowledge to inform their management decisions.

In sum, there is no indication that a lack of understanding and ability to apply the monitoring procedures constitutes a serious constraint to the production of the information presented in the monthly reports, although the effect of minor flaws in following monitoring procedures cannot be excluded. The fact that the VNRCs stressed the importance and value of the monitoring system despite not utilising its potential systematically can, however, be interpreted in a number of ways, which we will return to below.

How locally-based monitoring produces social order and vice versa

The following section will seek to demonstrate how the results presented so far can be interpreted when viewing the production and communication of information based on the locally-based monitoring system as part of an ongoing struggle to establish and reproduce the social order within the context of the collaborative forest management process.

VNRC membership, and particularly being a VNRC leader (i.e., chairman, secretary or treasurer), is a lucrative position in many of the villages and VNRC members and patrol guards often make considerable efforts to be re-elected and in some cases lobby for an extension of the election period for VNRC membership. VNRC members and patrol guards receive allowances for meetings, patrols and other activities based on the revenue generated from fines and taxes on forest produce and services. VNRC leaders in the woodland area are, in addition, usually paid extra allowances on a monthly basis to compensate for their extended responsibilities. Some VNRC members further benefit from travel allowances for going to town to deposit money in the bank, etc. Allowances

are however, smaller and less regularly paid in the montane area due to the lower income of VNRCs there (Nielsen 2011; Nielsen and Treue 2011). VNRC members also benefit from allowances and salaries paid by visiting researchers, students and officials. Two VNRC leaders in the woodland area testified that income from the VNRC is crucial to their livelihoods, stating that they would not know what to do if they lost their positions. Patrol guards, at least in the woodland areas, also receive allowances for patrols and for escorting traders in forest products to the forest. That this creates significant incentives is evident from the tough competition to become a patrol guard, as observed in Tano at the VNRC elections in 2010. In addition to the legally obtained benefits, some VNRC members and patrol guards benefit from collusion with forest users and traders in forest products and, in some instances, from embezzlement of VNRC funds as will be further discussed below. It is thus clear that many VNRC members and patrol guards perceive substantial benefits from their positions, and in the following discussion we will seek to describe the strategies they employ to maintain access to these benefits, as well as the consequences of these strategies for the information produced and communicated.

The fact that virtually all VNRC members as well as patrol guards stressed the importance of the monitoring system procedures despite apparently not using the information to evaluate trends may indicate that the complexity of the procedures constitutes a convenient argument for the continued tenure of the VNRC members who have received training. It was thus observed that VNRC members use their superior insight into the procedures in relation to monitoring as an argument against the election of new people to the VNRCs [see also Funder et al. (Unpublished)]. Another way in which the complexity of the monitoring procedures is used as a vehicle for other purposes is through requests in the monthly reports for more training, which would entail economic benefits in the form of allowances for participants.

Access to benefits by VNRC members depends on the individual members' ability to maintain a position in the committee and to conceal irregularities, such as embezzlement and collusion with forest users¹¹. Ultimately, however, it also depends on the committee being able to maintain its management rights by complying with management agreements and being able to successfully pass or avoid DLNRO scrutiny. This may generate incentives to conceal and/or misrepresent information to fellow villagers and the DLNRO. When interviewed, all eight VNRCs clearly considered the monthly reports as having a control function by enabling the DLNRO to check on their activities. Furthermore, all VNRCs were aware that the DLNRO, in theory, could revoke management agreements if objectives were not met. According to the responsible district forest officials, threats of revoking management agreements had been issued in relation to 'problematic' VNRCs¹². The credibility of the control function is underlined by the fact that all receipt books from the woodland area are examined by the financial officer at the DLNRO in order to calculate the 5 per cent district tax on

VNRC revenue. VNRC members may, however, have learned that the DLNRO officers apparently do not scrutinise monthly reports and compare the financial information with that in receipts and vouchers. Further, whereas the monthly reports are submitted every month, receipts and vouchers are only examined 1–3 times per year. This delay facilitates 'borrowing' of funds, where a VNRC leader (as he/she is usually responsible for keeping the books) can assure that embezzlement goes undetected for some time by manipulating the information in monthly reports and concealing the information recorded in receipts and vouchers from fellow VNRC members and villagers¹³. Interviews support that most embezzlement cases start out in this way as minor issues and later go out of control. Importantly, this crude way of embezzling funds is only possible because VNRC leaders are able to withhold financial information from fellow VNRC members and the community in general. In the montane area, there is no tax on revenue and VNRCs at most have experienced one audit of records without any consequences of observed discrepancies in their accounts¹⁴. Accordingly, VNRCs in the montane area may perceive control as less strict. Furthermore, VNRCs have virtually no experience with control surveys being carried out in the forest, and, as pointed out by the VNRC in Mbili, "the district forest officer cannot know whether we are reporting the truth because he is far away." But the VNRCs consider it very likely that surveys in the forest or an audit of accounts will be conducted if irregularities are suspected by the DLNRO.

Most VNRCs have seen at least one, and some several, incidences of embezzlement (i.e., that one or more members of the VNRC have unlawfully used VNRC funds for private gain). The amounts involved have ranged from ten thousand to several hundred thousand shillings. A case from Mbili, for instance, culminated in October 2004 with the flight of the VNRC chairman who was also acting as VNRC treasurer. Suspecting malpractice, community members and members of the VNRC complained to the DLNRO who initiated an audit of the accounts, revealing that approximately TZS 93,000 was missing. This example of embezzlement correlates well in timing and amount with the discrepancy between information in monthly reports and receipts presented above. Examples from other villages are abundant¹⁵, although some may partially represent ongoing power struggles within the VNRCs and associated strategic information¹⁶. There are also examples of embezzlement of VNRC funds by village chairmen or village executive officers managing VNRC funds, some of which may explain other discrepancies in discrete time periods¹⁷. However, in some cases, alleged mismanagement could not be confirmed by simple comparison of records¹⁸. For obvious reasons, embezzlement and mismanagement distorts the information flow within the VNRCs and, as a consequence, the information presented in the monthly reports. Information also appears to be actively withheld from the constituency by failing to present accounts at quarterly village general assemblies in accordance with management plans. Of 89 village meeting minutes from the montane area, only 6 per cent indicate that information on VNRC accounts were presented and never by VNRC members

themselves. Hence, embezzlement cases may explain much of the gap observed between the income and expenditure reported in monthly reports and that recorded in receipts and vouchers.

Other attempts at gaining and maintaining access to benefits from forest management are even more detrimental to the quality of information and to sustainable forest management. Patrolling in the forest is hard work, and patrol guards, particularly in the montane area, where formal compensation is very low, face incentives to take shortcuts (including shirking responsibilities and filling in forms arbitrarily)¹⁹. In both woodland and montane villages, some utilisation of the forest furthermore goes unrecorded in both receipts and permits (legal utilisation) and patrol reports (unlicensed utilisation) because it is: not discovered, silently tolerated, or takes place in collusion with VNRC members and/or patrol guards. In the woodland area, a share of the charcoal production is unregistered because producers in some instances are able to produce on the same site twice and hence exceeding their permit without anyone noticing²⁰. In other cases, slack is silently tolerated. Charcoal producers, for instance, often hide a number of bags in the forest before calling the trader, who is always accompanied by a patrol guard who counts the number of bags before the trader can leave the forest. These bags are then smuggled out of the forest and hid in the homesteads of the producers or their relatives and from there either transported to town during the night or sold locally in smaller amounts. This is silently tolerated due to prior experience, where strict enforcement (i.e., by searching houses, etc.) has been countered by threats of physical violence and by burning down private homes and offices.

Some illegal resource use also occurs with the active collusion of VNRC members and/or patrol guards and is, therefore, not recorded. In several villages, there is evidence of collusion between individual producers and patrol guards. In some cases, patrol guards accept a bribe for turning a blind eye, but in others, patrol guards actively extort offenders²¹. One way in which collusion takes place is through recycling of receipts, where key VNRC members refrain from signing and stamping the receipt on the day products are transported out of the forest. Thereby, the trader can come back and reuse the same receipt without having to pay taxes for additional products²². In the montane village of Nne, where tourism and forest research represents the primary source of income, the high proportion of missing receipts according to serial numbers indicates the potential to siphon off VNRC funds by destroying the counterpart of receipts issued for forest permits for foreigners, with little chance of evidence of this income being availed for audits. Finally, at least one patrol guard in the montane area secretly hunted the wildlife that he was supposed to protect for the community while other guards collected NTFPs including animals caught in hunters traps, and therefore had little incentive to remove traps [see also Nielsen and Treue (2011)].

The important point of these examples is that they illustrate that an unknown share of resource extraction never enters as data in the monitoring system, implying that the communicated information is impaired in relation to assessing resource use

patterns and ensuring sustainability. It is thus clear that the monitoring information understates the magnitude of financial flows and forest disturbances—albeit to an unknown extent. To sum up, the real and perceived oversight by the constituency and DLNRO implies that individual VNRC members, in order to gain and maintain access to legal and extralegal benefits from VNRC membership, appear to have considerable incentives to report positive trends in ecological monitoring data and conceal discrepancies in financial management by withholding or only presenting one source of information.

DISCUSSION AND CONCLUSION

We set out to contribute to the literature on locally-based monitoring by taking a closer look at how the production and communication of information in locally-based monitoring takes place within the context of a continuous struggle to reproduce and redefine the social order surrounding it. Our point of departure was the noticeable fact that the recent literature on locally-based monitoring displays a great deal of optimism about the prospects of involving people living around conservation areas in the systematic gathering of information about their condition and use to inform management decisions from local to national levels, with particular potential where management is shared.

Our results reveal contradictions between some information communicated by VNRCs in monthly reports under the locally-based monitoring system, interview statements made by the VNRCs and changes observed through transect surveys in the forest. Furthermore, financial information communicated in monthly reports tends to under-represent actual financial flows, and discrepancies are often concentrated in discrete time periods that coincide with known cases of embezzlement. Interviews and observations further indicate that the production and communication of information under the locally-based monitoring system generally takes place under conditions of ongoing struggles over access to benefits from collaborative forest management. Finally, the result that the information in the monthly reports is only scarcely used or discussed by VNRCs and that the ecological trends appearing in them are not reflected in the perceptions of VNRC members indicates that the locally-based monitoring system has limited relevance to the actual management practices of the VNRCs. However, the discrepancy between the information in monthly reports and the perceptions revealed to us through interviews could be another example of strategic communication. Hence, it seems relevant to pose the question whether the locally-based monitoring setup in this case has not failed on both its stated objectives of 1) providing an information basis for discussion and informed management decision-making in the communities and 2) generating accurate information to higher authorities about the performance of collaborative forest management. Although our results do not allow us to draw firm conclusions on this question, they do caution that the information produced and communicated under locally-based monitoring systems is shaped by incentives structures

and power struggles in the particular context within which they are based.

When evaluating the results of this study in the larger context of locally-based monitoring in developing countries, it is worth noting that the case study area is considered a showcase of successful collaborative forest management and locally-based monitoring, and that the villages have received intensive project support in the implementation phase and have been the focus of considerable research efforts (e.g., Topp-Jørgensen et al. 2005; Lund 2007; Sauer and Abdallah 2007; Lund and Treue 2008; Danielsen et al. 2009; Vyamana 2009; Nielsen 2011; Nielsen and Treue 2011). Yet, even under such 'favourable' conditions, the production and communication of information is shaped by a diverse range of agendas and purposes, including that those in charge of production and communication of information at the village level appears to perceive incentives to present information that show good performance relative to the management objectives to ensure re-election and to placate and avoid control by the DLNRO. This is reinforced by the inability of the DLNRO to conduct regular surveys in the forest or comprehensive audits of accounts. These issues obviously reduce the value of the monitoring system in relation to tracking ecosystem response to legally sanctioned use as well as unlicensed use, with implications for sustainability and future exploitation. The results also indicate that a considerable amount of funds that should have been spent on local development, etc., is being misappropriated and that communities in several cases suspect or are even informed about it (Lund and Treue 2008; Nielsen 2011; Nielsen and Treue 2011).

Our findings complement literature evaluating community-based conservation initiatives in a multitude of locations, indicating that conservation generally is contested and riddled with struggles over access to resource and benefits (Agrawal and Gibson 1999; Ribot et al. 2006, 2010; Larson and Ribot 2007). This study shows that these well-known problems also pose a challenge to locally-based monitoring in particular, if perceived locally to generate information that can be used by higher level authorities to evaluate whether management fulfils standards set by a contract specifying local management rights and responsibilities over natural resources. Further, our findings specifically highlight the difficulties associated with efforts to increase transparency and accountability at the local level through institutional design, in a context of weak local government institutions (Brockington 2008). Tanzanian local governments have, in this respect, been plagued by corruption, coercion and violence (Kelsall, 2000; Fjeldstad 2001; Brockington 2007). However, despite the problems observed in this case and others, we do not argue for the abandonment of community-based conservation approaches. There are sound theoretical arguments for approaches that favour local decision making-authority and also a growing number of examples of its merits in relation to forest management (e.g., Chhatre and Agrawal 2009; Roe et al. 2009; Ribot et al. 2010). Rather, we believe, as we have stated already, that our findings should serve as a/another note of caution against expectations that

community-based conservation is a silver bullet that will automatically bring about conservation, improved rural livelihoods, and good governance.

It is thus clear that considerable caution and consideration of stakeholder incentives is required in the use of information generated through locally-based monitoring in relation to conservation and development projects. This also has implications for the ongoing REDD+ discussion. The REDD+ debate recognises that monitoring will be a difficult and costly aspect of the strategy (Angelsen 2008; Skutsch et al. Unpublished). Locally-based monitoring and forest inventory has therefore been suggested as a supplementary approach to remote sensing, that in addition to monitoring of carbon stocks, can support development of social capital, enhance the local ownership to carbon emission reduction efforts, and contribute to local accountability, transparency and benefit sharing (NORDECO 2009; Skutsch et al. Unpublished; Danielsen et al. 2011). However, our results illustrate that this outcome is far from certain and that such a strategy could be risky, as it appears likely that REDD+ schemes could produce strong incentives to over-report on conservation outcomes by communities to attract higher carbon payments.

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Notes

1. No significant differences were found in precipitation or other climate or environmental indicators between 2001 and 2008 that would suggest uneven likelihood of migration between the two years (Nielsen Unpublished data).
2. Individual transects were surveyed in 200 m intervals separated by 50 m to facilitate calculation of confidence intervals (Buckland et al. 2001).
3. Due to the number of comparisons, results are presented in a tabulated form as observations per sq km. For illustrations with 95% CI bars, see Nielsen (2011) and Nielsen and Treue (2011).
4. The VNRC in Nne, for instance, claimed negative trends in active traps despite never having recorded any observations of traps in monthly reports to support this claim, and in contradiction to changes observed from transect surveys. Other discrepancies include claims of large increase to stable trends for blue, Harvey's, and Abbott's duiker, bush pig and eastern tree hyrax (see Table 2).
5. Reports from Mbili on 14 occasions include the statement 'animals are increasing' although observations presented in monthly reports indicate negative trends for all three duiker species. Transect surveys furthermore indicate stable low relative densities for most species on the transect

adjacent to Mbili. Reports from Nne on six occasions contain similar remarks although the VNRCs' own monthly reports indicate negative trends for five out of six species. Transect surveys furthermore indicate negative trends for medium sized and larger species on transects close to human habitation. Reports from Tatu on three occasions contain claims of increasing animal densities although observations in reports indicate negative trends for a number of species. However, in this case, transect surveys indicate a considerable and significant increase for several species [see also Nielsen and Treue (2011)].

6. See Lund et al. (2007) for a brief description of this re-centralisation. Four villages not submitting monthly reports for one year should add up to 48 missing reports. However, despite not being able to allow any forest utilisation—and thereby collect revenue to pay for the performance of management duties, including patrols—the VNRCs in Tano and Sita continued the management and submitted 21 monthly reports during 2006.
7. Internal transactions include dispersal of funds from the zonal committees to individual VNRCs in villages surrounding the forest reserve and transfer of funds from VNRCs to the zonal committee for deposit in the joint bank account.
8. The fact that the discrepancies in income and expenditure almost exactly cancel each other out could suggest that this is an example of flawed and reversed recording in receipts and vouchers. However, this does not appear to be the case as will be discussed in relation to known cases of embezzlement.
9. Indicating that at least some of these discrepancies are intentional, four instances of multiple versions of the same monthly report were observed. In all cases, the variation occurred in financial aspects, whereas other aspects of the reports were identical.
10. Patrol guards in Moja only recorded the first dung pile observed from each species while those in Mbili claimed searching until at least one observation of each species was made. The same issue appeared to be the case in Tano. Data on wildlife observations from these villages should therefore be less sensitive to change in wildlife densities. This, however, does not explain the observed discrepancies in information in relation to these villages.
11. In all four woodland villages, VNRC members have been ousted between elections on at least one and up to five occasions, usually on grounds of embezzlement or collusion with producers and/or traders in charcoal.
12. Lastly so in relation to a round table discussion with the VNRC in Nne.
13. The fact that the district tax is based on net income furthermore means that the DNLRO likely does not examine expenses recorded in either vouchers or monthly reports, enabling corrupt individuals to fake expenses. On the other hand, expenses, particularly for allowances, are often highly contested in communities where accounts are discussed at village meetings.
14. Where problems in the account had been detected following standard audits, explanation of procedures rather than reprimands had been issued. As VNRC records in Mbili were confiscated in 2004 following and embezzlement case (see text below), another audit was considered impossible.
15. Usually, cases are solved at the village level with the offender admitting his or her guilt and, in some cases, repaying all or some of the embezzled amount.
16. VNRC meeting minutes of June 20, 2006 from Moja, for instance, mentions suspicion of embezzlement by the former VNRC chairman. The chairman allegedly took TZS 12,000 for bike repairs but as no work had been done on the VNRC bike, the new VNRC decided to raise the case with the village council. The amount, however, does not cover the discrepancy in records observed prior to the 2005 election. And as the former chairman remained member of the VNRC, the decision against him may just as well be an example of an ongoing power struggle within the VNRC as based on any evidence of embezzlement [see also Nielsen and Treue (2011)].
17. According to the VNRC in Moja, its accounts were administered by the village treasurer under supervision of the village chairman and all income was initially paid into the village accounts to avoid having to

share it with other villages through the zonal committee. These funds were then supposed to be handed over to the VNRC to cover salaries. However, the VNRC complained about not receiving documentation for this income, that a written application was demanded by the village chairman for disbursement of funds and that this was often denied. The VNRC, however, recorded this income in monthly reports according to requirements. This may explain the discrepancies in the monthly reports from Moja from July 2006 onwards. Unfortunately, it was not possible to get a statement from the village chairman, who was removed from office following an investigation by district authorities and currently awaits trial accused of embezzling TZS 10 million (approximately USD 8,700). Similar problems occurred in Mbili, but because the VNRC's accounts were confiscated by the DNLRO, subsequent discrepancies are not revealed in the analysis that only compares months for which both types of records appear. Also, in this village, it was not possible to obtain a statement from the village chairman [see also Nielsen and Treue (2011)].

18. Financial records from Nne, for instance, appear relatively solid. Community members, however, considered development projects funded by the VNRC as insignificant compared to the assumed income and rumors of embezzlement were widespread. Projects funded by the VNRC included forest boundary clearing, purchasing school books and desks, and constructing toilets for the ward secondary school. Examining the records revealed that vouchers often were not signed or were signed by VNRC members and there were discrepancies with the amounts and items stated as received by contractors and the school headmaster respectively. A number of workers also complained about not having been paid for forest boundary clearing, and bushmeat hunters claimed to have been fined without receiving a receipt.
19. As an example, it was observed during a visit in 2002 that patrol guards in one woodland village had noted observations of a number of elephants in their patrol forms. However, elephants did not occur in this area and forms were apparently filled out in a hurry the same day based on rumors that the team would visit this village.
20. Producers may use smaller branches from the tree crowns and fell 1–2 extra trees to quickly produce 5–8 bags on the site where they just finished the legal production. This is very difficult to discover afterwards as patrol guards can hardly know if an extra few trees are felled, even if they have shown producers the area and trees to cut and, possibly, have checked upon the producers during the legal production.
21. In the montane village Tatu, patrol guards had allegedly sought out a bushmeat hunter demanding extortion not to report his illegal activities and to have his traps returned with the threat of formal prosecution.
22. Some VNRC members in Sita were recycling receipts in 2010. In 2004–2005, the villages of Saba and Nane saw rampant illegal production of charcoal in their forests. In this case, other VNRC members and village leaders discovered what was going on because of the magnitudes of production (several hundred bags of charcoal) and initiated action, resulting in the ousting of the offenders from the VNRC.

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