Determinant of the Effectiveness of Participatory Forest Management in Tanzania

Razack B Lokina* and Elizabeth J Z Robinson

*Corresponding author

Razack B Lokina
Coordinator and Lecturer
Environment for Development Tanzania
Department of Economics
University of Dar es Salaam
Tanzania

Elizabeth J Z Robinson
Fellow and Lecturer
Environment for Development Tanzania
Department of Economics
University of Dar es Salaam
Tanzania

Abstract

Following the 1998 National Forest Policy and the Forest Act of 2002, participatory forest management is being introduced in Tanzania. PFM has been proposed as a way of both protecting Tanzania's forests and reducing rural poverty. In this paper we analyse villagers' perceptions of the effectiveness of PFM in Tanzania, using household and village level survey data collected from two regions. Preliminary findings indicate that men, larger households, and those households that have their own source of fuelwood are more likely to perceive a particular PFM initiative as successful.

Keywords: Forests, Participatory forest management and Tanzania

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1. Background

Following the 1998 National Forest Policy and the Forest Act of 2002, participatory forest management (PFM) is being introduced in Tanzania. The underlying reason for the introduction of PFM is in part a consequence of the realisation that many of Tanzania's forests, particularly those that are most important for ecosystem provisioning including the protection of biodiversity, have become increasingly degraded and encroached, in part due to a lack of commitment and funding for enforcement effort required to keep people out of the forests. Villagers typically use the forests as an open access resource, whether as a source of products primarily to be consumed at home, such as non-timber forest products (NTFPs) such as fuelwood, forest fruits and vegetables and medicine, and building materials, or for income generating activities such as timber and charcoal production.

Participatory forest management is a new approach to conceptualizing the role of forests within the livelihoods of rural people that has been proposed as a way of both protecting Tanzania's forests and reducing rural poverty. The policy advocates private and community based forest management (CBFM) and provides legal basis for Joint Management (JFM) of the forest reserves with catchments or biodiversity values. Under CBFM villagers can declare and gazette forest areas on village land as "Village Land Forest Reserves." Villagers take full management responsibility, setting and enforcing rules and regulations over the forest management and use, including the collection NTFPs. Under JFM more restrictive extraction rules are typically implemented, particularly in preservation reserve forests that are particularly important for ecosystem provisioning and biodiversity protection. In these forests, effective JFM could result in villagers being responsible for protecting the forests, and taking on the costs of protection, but losing their current *de facto* rights to collecting NTFPs such as fuelwood and forest vegetables and fruits (Kajembe and Nzunda, 2002; Ramadhani, as reported in Mertz, 2005; Lovett, in press).

These possible consequences of PFM on both ecosystems and the rural poor have not been considered sufficiently, in part because of the lack of data concerning the current

contribution of Tanzania's forests to the nearby communities, and in part because of the lack of an appropriate analytical framework for addressing and measuring the impact of PFM on both forest resources and rural livelihoods. This paper builds on recent new theoretical advances (Robinson et al, 2002 and 2005), providing an empirical estimation of the determinants of successful PFM. First we explore villagers' perceptions of the impact of PFM on the PFM forest itself, their own livelihoods, and other forest resources. We compare these perceptions with the villagers' perceptions of "success" of PFM, based on their own criteria. We then consider how these different perceptions of the impact on PFM are determined by characteristics of the PFM initiative itself, village characteristics, and villagers' own characteristics.

2. Literature and theoretical underpinning

A growing body of literature addresses specific aspects of NTFP extraction, typically either the total quantity of resources extracted, or their contribution to livelihoods (for example, de Beer and McDermott, 1989; Fearnside, 1989; Poulsen, 1990; Ganesan, 1993; Gunatilke et al, 1993; Bahuguna, 2000; Cavendish 2000, Mahapatra et al, 2005). Lewis (2002, p.9) recognises that "concentrating previously dispersed … activities into certain parts of the forest may actually increase the negative ecological impact … by concentrating it in limited areas," implying that the level of environmental services provided by the forest as a whole can be negatively effected by the displacement of extraction from a particular protected area. Forest and park departments are under increasing pressure to address the impact of their policies on resource dependent villagers in and around the forests (White and Martin, 2002; Wells, 2003). Yet though the consequences for nearby forests have in part been recognised in the literature, there has been less explicit account of the impact on household welfare (Faith, 1996; Vandergeest, 1999; Kohlin and Parks, 2001; Sekhar and Jørgensen, 2003; Pattanayak, et al. 2004). Gosalamang et al (2004) is a notable exception of a paper that has looked at changes in legal status of a forest reserve and its impact on household livelihoods in sub-Saharan Africa.

Theoretical research identifies two distinct effects when villagers are excluded from an area where they have traditionally collected resources: a "displacement effect" in

which the villager extracts more intensively elsewhere thereby displacing the problems of degradation to other forest areas and a replacement effect in which villagers replace the extracted product with a purchased product thereby possibly increasing pressure on a more distant forest which supplies the market (Robinson, et al 2002 and 2005). A further replacement effect, not identified in Robinson et al (2005) occurs when villagers start to cultivate NTFP substitutes on their own land (such as planting a woodlot).

3. Data and Methodology

We collected our data from 50 villages in two regions where PFM initiatives have been implemented; using both an individual household survey administered to 20-25 households per village, and village level focus group discussions. The individual household data provided information on villagers' individual perceptions of the impact of PFM in terms of the impact on the forest itself, other less-protected forests, and their own access to forest resources. The village-level focus groups provided us with village and PFM-level data such as access to markets, the number of forests around the village, and whether a CBFM or JFM initiative. The survey was done in two phases. Firstly, we undertook a pilot survey to test the survey instruments. We then modified the final survey forms according to our preliminary findings. In total we surveyed about 1000 households from the two regions. The data collected include factors both exogenous and endogenous to the PFM process, the current state of the nearby forests and villager livelihoods, and perceptions of change over time.

3.1. Defining successful PFM

It is not obvious how we should define success in terms of a participatory forest management initiative. PFM was introduced with a dual aim, both to improve the quality of forest resources and to reduce poverty. Therefore it would seem reasonable to include both these dimensions of success. Given that successful protection of forest resources within a particular PFM initiative might result in increased degradation of forest resources elsewhere, as predicted by, for example, Lewis (2002) and Robinson et al (2005), we therefore need to take account of forest resources both within and

outside the PFM initiative and how extraction affects the ecological value of the forest resources (Robinson et al, 2005).

Ideally, changes over time in the state of forest reserves would be determined by monitoring the forest resources, with baseline data being collected before the implementation of the PFM initiative, and further data being collected at intervals after the implementation. Similarly, the impact of a particular PFM initiative on villagers could be determined using panel data that takes into account the villagerws' situation before PFM is introduced and the impact of other factors on livelihoods and the distribution of costs and benefits of the PFM initiative. However, in many of the PFM forests this baseline data is not available. We therefore had a number of options. One was to collect our own baseline data from villages where PFM was planned for the future, and then update this data after PFM had been introduced, before attempting to answer any of our research questions. This would have delayed our research considerably. But more than that, it would not have given us a chance to assess the impact of the considerable number of PFM projects that have already been introduced over the past several decades. Therefore we took the following approach. First we asked the villagers an open ended question of whether they felt that PFM had been a success or not, without giving them specific parameters by which to measure the success. We then asked villagers both at the individual household level, and at the village level through focus groups, how they perceived the quality of the PFM forest had changed as a result of the PFM initiative; how their access to forest resources had changed as a result of the initiative; and how they felt the quality of other forest resources had changed as a result of the initiative. That is, we asked them on three key dimensions of success from a social welfare perspective. We used a scale of 1 through 5 where 1 denoted a perception of a very negative impact, 3 a neutral perception, and 5 a very positive perception. As a consequence we have villagers' perceptions rather than detailed calculations of the actual impact of PFM. However, given that the success of PFM is in part subjective and depends on the impact on different households; given the data limitations, in particular the lack of baseline data; we feel that this is a novel and interesting approach.

4. Findings

4.1 General description of the variables

All the household surveyed are predominately agricultural rural communities dominated by farming as their economic activity (89%). About 30% of the heads of household in the sample are uneducated; about 57% finished at least the basic primary education; 10% have up to four years of secondary schools; and 3% more than four years of secondary education. The average age of the household head is 43 years; the youngest in our survey was 21 and the oldest 90 years old. About 29% of the households collect fuelwood from their own farmland suggesting that majority depend on the forests around their villages for their primary source of energy. Very few villagers are collecting NTFPs other than fuelwood from the forests, suggesting that strict measures preventing access to the PFM forests have been undertaken. One of the objectives of the PFM is to create a situation where the household and communities are engaged in tree planting. In our sample we found that about 54% of the households surveyed have indeed planted trees in their own farm, though not necessarily in response to the PFM initiative. Table 1 summarises the details of the variables used in the analysis.

Table 1: Summary statistics of the variables used in the analysis

Variable	Units	Mean	Std. Dev.	Min	Max
Lnage	Years	3.72	0.32	3	5
Sex	Dummy	0.66	0.48	0	1
Noeduc	Dummy	0.30	0.46	0	1
Primary	Dummy	0.57	0.50	0	1
Hhsize	Number	5.26	2.33	1	17
Morogoro	Dummy	0.44	0.50	0	1
Moro rural	Dummy	0.25	0.44	0	1
Mvomero	Dummy	0.20	0.40	0	1
Muheza	Dummy	0.21	0.41	0	1
Wood	Dummy	0.39	0.49	0	1
Lnincome	Tshs	12.86	1.64	0	17
Farmer	Dummy	0.89	0.31	0	1
Market	Minutes	73.78	65.85	1	720
Transmode	Dummy	0.81	0.40	0	1
Logexpenditure	Tshs	10.32	0.97	6	17
Logwoodqty	Bundle	1.36	1.73	0	6
Ownfuelwood	Dummy	0.29	0.45	0	1
Odeadtree	Dummy	0.43	0.50	0	1
lnwodcost	Dummy	2.48	3.36	0	9
lnbrncost	Tshs	4.01	3.33	0	9
Ffruits	Dummy	0.16	0.37	0	1
fmedicine	Dummy	0.17	0.37	0	1
Ropes	Dummy	0.09	0.29	0	1
Timber	Dummy	0.06	0.23	0	1
Grases	Dummy	0.21	0.41	0	1
bushmeat	Dummy	0.01	0.08	0	1
plantedt	Dummy	0.54	0.50	0	1
jfmcbfm	Dummy	0.03	0.18	0	1
comanaged	Dummy	0.52	0.50	0	1
Accjfm	Dummy	0.13	0.34	0	1
Cbfm	Dummy	0.53	0.50	0	1
Jfmpreserve	Dummy	0.71	0.46	0	1
Jfmproduc	Dummy	0.27	0.44	0	1
Govtplant.	Dummy	0.47	0.50	0	1
Prvtplant.	Dummy	0.47	0.50	0	1
Farmwood	Dummy	0.81	0.39	0	1

4.2 Regression analysis

We undertook an ordered logit model on the perceptions of the PFM performance, the results of which are presented in Table 2. The model was estimated to get a general feeling of what is driving villagers' overall perceptions of the success of PFM. The dependent variable is an ordered rank of the perceived success, where very successful is "1"; somewhat successful or little successful "2", and not very successful or not at all successful "3". Table 2 present the results.

Table 2: Ordered Logit Model, dependent variable successJfm

	Coef.	Std. Err.	z	P>|z|
Socio-economics and Demographic variables				
Lnage	-0.254	0.244	-1.040	0.298
Sex	0.147	0.160	0.920	0.359
Noeduc	0.185	0.269	0.690	0.492
Primary	0.013	0.223	0.060	0.952
Hhsize	0.001	0.032	0.030	0.972
Morogoro	1.246**	0.477	2.610	0.009
Morogoro rural	-0.979***	0.266	-3.680	0.000
Mvomero	1.291***	0.309	4.180	0.000
Muheza	0.182	0.257	0.710	0.479
Market	0.000	0.001	0.340	0.736
Logexpenditure	-0.238***	0.083	-2.860	0.004
PFM related Variables				
Grasses	-0.204	0.189	-1.080	0.279
Jfmcbfm	2.669***	0.479	5.570	0.000
Participation	0.516***	0.154	3.340	0.001
Accjfm	0.244	0.219	1.110	0.265
Frwcbfm	-0.840***	0.260	-3.220	0.001
Frwocbfm	-0.610**	0.243	-2.510	0.012
Jfmpreseve	2.079***	0.326	6.380	0.000
Jfmprodn	1.503***	0.440	3.410	0.001
Nojfmprodn	-2.175***	0.570	-3.810	0.000
Nonjfmpresev	1.089***	0.384	2.840	0.005
Prvtfrst	0.517**	0.241	2.150	0.032
Shambfrst	-0.113	0.227	-0.500	0.617
Jfmcond4	0.471*	0.280	1.680	0.093
Forestqlty	-0.202	0.247	-0.820	0.413
Forestacc	-0.289	0.219	-1.320	0.187
Forestoth	-0.094	0.194	-0.480	0.628
Illegal	0.481	0.331	1.450	0.146
Vlivelihod	0.520**	0.202	2.580	0.010
cut1	-0.449	1.368		
cut2	1.982	1.367		
Log likelihood	-729.712			
Pseudo R2	0.165			
Number of obs	921			

Many of the variables are statistically significant and the significant variables can be found in all the two sub-groupings of socio-economic and demographic variables as well as village and household characteristics. Because the direction of change in an explanatory variable is not clear from the sign associated with the coefficient (Long 1997) we concentrated our discussion on the marginal effects parameters reported in Table 3.

Table 3: Marginal Effects of the significant variables

Socio-economic and demographic variable						
	very successful		successful		not successful	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat.
Lnage	0.0623	1.0400	-0.0473	-1.0400	-0.0150	-1.0400
Sex	-0.0360	-0.9200	0.0275	0.9200	0.0085	0.9300
Noeduc	-0.0455	-0.6900	0.0342	0.6900	0.0113	0.6700
Primary	-0.0033	-0.0600	0.0025	0.0600	0.0008	0.0600
Hhsize	-0.0003	-0.0300	0.0002	0.0300	0.0001	0.0300
Morogoro	-0.2996***	-2.7600	0.2170***	2.9600	0.0827**	2.2500
Morogoro rural	0.2216***	4.1600	-0.1767***	-3.9800	-0.0449***	-4.3600
Mvomero	-0.3110***	-4.5600	0.2011***	5.5800	0.1099***	3.0700
Muheza	-0.0450	-0.7000	0.0337	0.7100	0.0113	0.6700
Market	-0.0001	-0.3400	0.0001	0.3400	0.0000	0.3400
Logexpenditure	0.0584***	2.8600	-0.0443***	-2.8200	-0.0141***	-2.7900
PFM related Variables						
Grasses	0.0497	1.0900	-0.0382	-1.0800	-0.0115	-1.1300
Jfmcbfm	-0.4976***	-11.1300	0.0845	1.1100	0.4130***	3.6200
Participation	-0.1259***	-3.3700	0.0954****	3.3400	0.0305***	3.1900
Accjfm	-0.0606	-1.1100	0.0449	1.1400	0.0157	1.0300
Frwcbfm	0.2043***	3.3100	-0.1520***	-3.3500	-0.0523***	-2.9600
Frwocbfm	0.1476***	2.5800	-0.1129***	-2.5500	-0.0347**	-2.5800
Jfmpreserve	-0.4359***	-8.6500	0.3403***	8.2400	0.0956***	6.7800
Jfmprodn	-0.3588***	-3.7500	0.2387***	4.5300	0.1201**	2.6200
Nojfmprodn	0.4455***	5.2500	-0.3500***	-5.2700	-0.0954***	-4.4200
Nonjfmpreseve	-0.2654***	-2.9600	0.1877***	3.2300	0.0777**	2.3500
Prvtfrst	-0.1265**	-2.1700	0.0952**	2.1700	0.0313**	2.0700
Shambfrst	0.0279	0.5000	-0.0210	-0.5000	-0.0069	-0.4800
Jfmcond4	-0.1169*	-1.6800	0.0842*	1.7900	0.0328	1.4400
Forestqlty	0.0498	0.8200	-0.0376	-0.8200	-0.0122	-0.8000
Forestacc	0.0696	1.3500	-0.0540	-1.3200	-0.0156	-1.4300
Forestoth	0.0230	0.4900	-0.0175	-0.4800	-0.0055	-0.4900
Illegal	-0.1185	-1.4600	0.0882	1.4900	0.0303	1.3600
Vlivelihood	-0.1271**	-2.6100	0.0961**	2.6000	0.0309**	2.5100

The regional dummies are significant. Respondents from Morogoro region appear less likely than those from Tanga to perceive PFM as very successful in their villages From the socio-economic variables almost all – age, sex, education and household size – are not significant. However, household expenditure, which we use as a proxy

for household income, appears to have a positive and significant impact on the household perception with regards to the success of the PFM. A higher household expenditure increases the probability that a household perceives the PFM initiative to be very successful.

One of the objectives of PFM is to improve forest quality and also contribute towards poverty reduction. We investigated this by controlling for villagers' livelihoods. We found that households were indeed less likely to perceive that PFM is very successfully if their own livelihoods have worsened as a result of PFM. The variable *vlivilihood* is significant and negative under very successful and positive and significant under successful and not very successful categories.

Villagers are more likely to rate PFM as being successful if the PFM initiative is in a JFM preserved forest and less successful if the PFM initiative is in a JFM production forest or a CBFM forest. This finding would fit with our observation that access restrictions should be greatest in the JFM preservation forests and therefore the quality of these forests should be greater than the other forests where PFM is introduced.

Many of the village level variables are significant in almost all the categories. Interesting results include that villagers in villages with both CBFM and JFM are least likely to perceive PFM as a success. Interpreting this result is tricky. Indeed, given that villagers may have different criteria of success, that could be influenced by, for example, information given to them by NGOs and other bodies, suggests that it is better to focus on villagers' perceptions of particular aspects of PFM. To that end, we analyse the impact of PFM in terms of the determinants of villagers' perceptions of the impact of PFM on quality of the PFM forest itself; other forests around the village; and villagers' access to forest resources. We undertook separate logit model estimations for each of these three dimensions, the results of which are presented in the tables below.

Table 4 provides results of the logit model that we ran considering villagers' perceptions of the impact of PFM on the quality of the PFM forest itself.

Table 4: Perceptions of the marginal effects of PFM on the PFM forest

variable |	dy/dx	Std. Err.	z	P>|z|
Socio-economic and demographic variables				
Lnage	-0.0631	0.0663	-0.9500	0.3410
Sex	0.0843*	0.0464	1.8200	0.0690
Noeduc	0.0707	0.0746	0.9500	0.3430
Primary	-0.0060	0.0652	-0.0900	0.9270
Hhsize	0.0237**	0.0093	2.5400	0.0110
Morogoro	0.1307	0.1496	0.8700	0.3820
Morogoro rural	-0.1613**	0.0785	-2.0500	0.0400
Mvomero	0.2360***	0.0729	3.2400	0.0010
Muheza	0.0714	0.0857	0.8300	0.4050
Lnincome	-0.0008	0.0160	-0.0500	0.9590
Lnland	-0.0301	0.0263	-1.1500	0.2520
Market	0.0004	0.0003	1.2500	0.2100
Logexp	0.0687**	0.0287	2.3900	0.0170
Ownfuewood	0.0965**	0.0447	2.1600	0.0310
Lnbrncost	0.0152**	0.0067	2.2600	0.0240
Ffruits	-0.0572	0.0568	-1.0100	0.3140
Fmedicine	0.0979**	0.0478	2.0500	0.0400
Timber	-0.1468*	0.0859	-1.7100	0.0880
PFM related variable				
Jfmcbfm	0.2677***	0.0632	4.2400	0.0000
Participation	0.1962***	0.0403	4.8700	0.0000
Accjfm	0.1541**	0.0632	2.4400	0.0150
Frwcbfm	-0.2249***	0.0809	-2.7800	0.0050
Frwocbfm	-0.1350	0.0968	-1.3900	0.1630
Jfmpreserve	0.1351	0.1070	1.2600	0.2070
Jfmprodn	0.4612***	0.0690	6.6800	0.0000
Nojfmprodn	-0.8758***	0.0490	-17.8900	0.0000
Nonjfmpreserve	0.2214**	0.1030	2.1500	0.0320
Govtfrst	0.2714***	0.0953	2.8500	0.0040
Prvtfrst	0.1444	0.0961	1.5000	0.1330
Shambfrst	0.0316	0.0954	0.3300	0.7400
Forestspartial	0.5762***	0.1240	4.6500	0.0000
forest2	0.1015	0.0872	1.1600	0.2440
jfmcond4	0.0715	0.0903	0.7900	0.4280
Shmbcond3	0.1670**	0.0750	2.2300	0.0260
Shmbcond4	0.1710**	0.0734	2.3300	0.0200
collect0	0.0438	0.1522	0.2900	0.7740
collect1	-0.4373***	0.1403	-3.1200	0.0020

These data suggest that men are more likely than women to perceive the quality of PFM forests to have improved as a result of the initiative; similarly larger households, better-off households, and those with their won source of fuelwood. Households who are more reliant on forests for their fuelwood are less likely to perceive that the quality of the JFM forest has improved considerably.

We were particularly interested in the impact of villagers' access to other forested areas on the PFM forest itself. We found that villagers in villages with one or more unprotected forest in addition to the PFM forest ((forestspatial) were significantly more likely to perceive that the PFM forest quality had improved considerably as a result of the initiative. This suggests that PFM is more likely to be successful in terms of the impact solely on the PFM forest when villagers simply displace their extraction activities into other less-protected forests and is in keeping with the predictions of Robinson et al (2005) and others.

Table 5 present the results of villagers' perceptions of the marginal effects of PFM on the quality of other forest in the village. We highlight here a number of interesting findings from this regression. Our prior assumption was that the introduction of PFM would have a neutral or negative effect on other forest resources, due to the displacement of NTFP collection from the newly established PFM forest into other less protected forests. However, we found that a number of villagers perceived that the quality of the other forests had indeed improved in tandem with improvements in the PFM forest quality. For example, better off villagers and villagers with their own sources of fuelwood are more likely to suggest that the nearby forests have also improved as a result of PFM. This could be because these villagers are less likely to use the other forests for fuelwood and so may not be able to judge the quality as well as other villagers and so perhaps assume that the quality of the other forests improves in the same way as the PFM forest.

In contrast, households which used to get fruits and grasses from the forest before the PFM initiative was implemented are more likely to perceive the impact of PFM on other forested areas to have been negative. This is an indication that these households may have shifted their NTFP collection activities into the other unprotected forests, where they have observed the quality of the forests to have deteriorated as a result.

Table 5: Marginal Effects of the Significant Variables: Forest others

variable |	dy/dx	Std. Err.	z	P>|z|
Socio-economic and demographic variables				
Lnage	0.0001	0.0523	0.0000	0.9980
Sex	-0.0410	0.0340	-1.2100	0.2270
noeduc	0.1633**	0.0633	2.5800	0.0100
Primary	-0.0351	0.0484	-0.7300	0.4670
Hhsize	0.0024	0.0066	0.3600	0.7170
Morogoro	0.0761	0.0950	0.8000	0.4230
Morogoro rural	-0.1633***	0.0364	-4.4800	0.0000
Mvomero	0.1043	0.0754	1.3800	0.1670
Muheza	0.2067***	0.0655	3.1500	0.0020
lnlabor	0.1326***	0.0427	3.1000	0.0020
Hired	0.1070**	0.0479	2.2300	0.0260
Lnincome	0.0066	0.0118	0.5600	0.5760
Lived	0.0011**	0.0006	2.0600	0.0390
Lnland	0.0207	0.0193	1.0700	0.2840
Logexpenditure	0.0314*	0.0179	1.7500	0.0800
Ownfuewood	0.1071***	0.0404	2.6500	0.0080
lnbrncost	0.0095*	0.0055	1.7300	0.0830
Ffruits	-0.0732**	0.0382	-1.9200	0.0550
Timber	0.0968	0.0792	1.2200	0.2220
Grasses	-0.0925***	0.0324	-2.8600	0.0040
Plantedt	0.0603*	0.0352	1.7100	0.0870
PFM related Variables				
Jfmcbfm	-0.0493	0.0792	-0.6200	0.5340
Participation	0.0373	0.0339	1.1000	0.2720
Accjfm	-0.0087	0.0455	-0.1900	0.8480
Frwcbfm	-0.0184	0.0534	-0.3400	0.7300
Frwocbfm	-0.1667***	0.0455	-3.6700	0.0000
Jfmpreserve	0.1580***	0.0490	3.2200	0.0010
Jfmprodn	0.1450	0.1012	1.4300	0.1520
Nojfmprodn	-0.2072***	0.0744	-2.7900	0.0050
Nonjfmpreseve	0.2600**	0.1061	2.4500	0.01p40
Prvtfrst	-0.0605	0.0574	-1.0500	0.2920
Shambfrst	0.0824**	0.0419	1.9700	0.0490
Forestspartial	-0.0975	0.0635	-1.5400	0.1250
forest2	0.1667**	0.0683	2.4400	0.0150
jfmcond4	-0.0522	0.0509	-1.0200	0.3050
Shmbcond3	-0.1030**	0.0441	-2.3400	0.0190
collect1	-0.1390***	0.0531	-2.6200	0.0090
shmcollect2	0.1367	0.0878	1.5600	0.1190

With regard to whether the forest access has changed since the PFM initiative, we estimate a logit model of access perception among the households. Table 6 provides the marginal results.

Table 6: Marginal effects of the Forest access perception

variable |	dy/dx	Std. Err.	Z	P>|z|
Socio-economic and demographic variables				
Lnage	0.0476	0.0328	1.4500	0.1470
Sex	-0.0448**	0.0230	-1.9500	0.0510
Noeduc	0.0586	0.0412	1.4200	0.1550
Primary	-0.0089	0.0288	-0.3100	0.7570
Hhsize	0.0046	0.0038	1.2000	0.2300
Morogoro	0.0547	0.0714	0.7700	0.4430
Morogoro rural	-0.0861***	0.0202	-4.2700	0.0000
Mvomero	0.1040*	0.0637	1.6300	0.1020
Muheza	0.1242**	0.0543	2.2900	0.0220
Farmer	0.0536***	0.0180	2.9700	0.0030
Branches	0.0618*	0.0359	1.7200	0.0850
Hired	0.0429	0.0325	1.3200	0.1860
Lnincome	-0.0092*	0.0056	-1.6300	0.1030
Lived	-0.0004	0.0003	-1.0700	0.2830
Lnland	0.0111	0.0117	0.9500	0.3440
Market	-0.0001	0.0002	-0.9400	0.3460
Logexpenditure	0.0340***	0.0112	3.0300	0.0020
Logwoody	0.0164	0.0103	1.6000	0.1100
Ownfuewood	0.0429	0.0357	1.2000	0.2290
Odeadtri	-0.0687***	0.0221	-3.1000	0.0020
Lnbrncost	0.0081	0.0060	1.3700	0.1720
Timber	0.0194	0.0501	0.3900	0.6990
Grasses	-0.0196	0.0201	-0.9700	0.3300
Plantedt	0.0572**	0.0217	2.6400	0.0080
PFM related variables				
Jfmcbfm	0.0532	0.1009	0.5300	0.5980
Participation	-0.0182	0.0219	-0.8300	0.4070
Accjfm	0.0324	0.0327	0.9900	0.3200
Frwcbfm	-0.0174	0.0370	-0.4700	0.6390
Frwocbfm	0.0080	0.0350	0.2300	0.8190
Jfmpreseve	-0.0157	0.0453	-0.3500	0.7290
Jfmprodn	0.0059	0.0555	0.1100	0.9160
Nojfmprodn	-0.1083**	0.0424	-2.5500	0.0110
nonjfmpreseve	0.0397	0.0591	0.6700	0.5020
Govtfrst	0.0160	0.0284	0.5600	0.5730
Prvtfrst	0.0629	0.0393	1.6000	0.1090
Forestsp	0.0815***	0.0152	5.3700	0.0000
Forest2	0.1372**	.0452	3.04	0.002
jfmcond4	0.0901	0.0579	1.5600	0.1190
collect0	-0.0641**	0.0289	-2.2200	0.0260
collect1	-0.0549*	0.0308	-1.7800	0.0750
Shmcolect2	0.1453**	0.0684	2.1200	0.0340

Women are more likely than men to perceive that the access to forest resources has worsened as a result of PFM, most likely because women are more involved in NTFP

collection than men. Similarly, those households more dependent on forests for their source of fuelwood are more likely to perceive that forest access as has worsened with the PFM initiative.

We had originally assumed that villagers in villages with JFM would be worse off than villages with CBFM. JFM typically should have much stronger access restrictions than CBFM as the latter forests are owned and managed by the villagers who determine how the forests can be used. In contrast, villagers are not permitted to collect anything from preservation JFM forests, and restrictions are tight even for production JFM villages. However, what we found when we undertook our village-level focus group discussions, and what was confirmed in our individual household survey, was that in the initial stages of PFM, whether JFM or CBFM, strict collection moratoria had been placed on the forests that lasted for at least 5 years and often more. And many of these initiatives are still less than five years old.

5. Discussion

When we asked villagers a very general question about their perceptions of the success of PFM, most were very positive. Yet when we asked villagers specific questions concerning the impact of PFM on the PFM forest itself, other forest resources, and their own access to forest resources, although we found that they were very positive about the impact on the PFM forest, they were much less positive about the impact on other forested areas around their villages and on their own access to forest resources and therefore on their own livelihoods. That the data show the strongest correlation to be between villagers' perception of the success of PFM and the impact of PFM on the PFM forest itself is not surprising. Despite PFM being introduced as a way of tackling forest management and poverty, PFM tends to be promoted in terms of its environmental impact rather than its impact on livelihoods.

PFM purports to be an approach to improving forest resources and livelihoods yet most villagers have been encouraged to see PFM only in terms of its environmental and ecological impact. Moreover, little attention has been paid to the impact on less protected forests around the villages. The fact that our regressions show very strongly that the impact of PFM on the PFM forest itself is more likely to be perceived as

successful if there are other less protected forests nearby suggests that displacement of extraction activities from the PFM forests to other forests is a significant problem and one that has not been addressed sufficiently by those involved in implementing PFM initiatives. Taking a landscape approach to forest management, rather than considering individual PFM initiatives would help to ensure that the impact on overall forest resources and on forest-dependent villagers' livelihoods are taken into account.

Appendix 1: Description of the variables used in the regression analysis

Variable	Description of the Variables
Lnage	Log of age of the household head
Sex	1=if the head of the household is a male, 0 otherwise
Noeduc	1 = if the head of the household have no education, 0 otherwise
Primary	1= head completed primary education , 0 otherwise
Hhsize	Household size
Morogoro	Regional dummy, 1=Morogoro region, 0, otherwise
Moro rural	District dummy, 1=Morogoro rural, 0 otherwise
Mvomero	District dummy, 1 =Mvomero, 0, Otherwise
Muheza	District dummy, 1 = Muheza, 0, otherwise
Wood	1 = if household collect wood from the forest, 0 otherwise
Lnincome	Log of household income
Farmer	1=if household main economic activity is farming; 0, otherwise.
Market	Distance to the market place in minutes
Transmode	1=if the mode of transport to market place by foot, 0 otherwise
Logexp	Log of household Expenditure
Logwoodqty	Log of quantity of wood collected from the forest
Ownfuelwood	1= if household collected fuelwood from own farm, 0 otherwise
Odeadtree	1 = if household collected dead tree from own farm
lnwodcost	Log of wood cost if purchased
lnbrncost	Log of tree branches cost if purchased
Ffruits	1 = of the household collect forest fruits, 0 otherwise
Fmedicine	1 = if the household used forest medicine, 0 otherwise
Ropes	1 if the household used ropes, 0 otherwise
Timber	1 = if household used timber, 0 otherwise
Grasses	1 if the household used grasses
Bushmeat	1 f the household used bush meat, 0 otherwise
Plantedt	1= if household planted tree, 0 otherwise
Jfmcbfm	1 if the village have both JFM and CBFM forest, 0, otherwise
Participation	1 = knoweldge of household involvement indecision making, 0, 0therwise
Accjfm	1 = if the household have access to JFM forest, 0 otherwise
Frwcbfm	1 = if there is forst with CBFM in the village, 0 otherwise
frwocbfm	1 = if there is a forest not under CBFM in the village, 0, otherwise
Jfmpreserve	1 = if there is jfm in preservation reserve forest in the village, 0, 0therwise
Jfmproduc	1= if there is nonjfm in production reserve forest in the village, 0 otherwise
Nonjfmpreserve	1 if there is non JFM in preserve forest, 0 otherwise
Nojfmprodn	1 = if there is non JFM production forest, 0 otherwise.
Govtplant.	if there is government plantation forest in the village
Prvtplant	1= If there is private plantation forest in the village, 0 otherwise
Shambfrst	1 =if there is shamba in farmland/wood lot, 0, otherewise
Jfmcond4	1= if the condition of woodlot is more or less the same, 0 therwise
Forestqlty	1= if the forest quality has improved considerably with PFM, 0 ottherwise
Forestacc	1= if the access to the forest has improved considerably, 0 otherwise
Forestoth	1 = if the other forest quality has improved considerably, 0, otherwise
Illegal	1 = if illegal activities in the forest has declined considerably, 0, otherwise
Vlivelihood	1 = if the village livelihood have improved considerably, 0, otherwise
Forestspartial	1 if in the village there are more than two forest, 0, otherwise
Forest2	1 = if in the village there are exactly two forests, 0 otherwise.
Shmcolect3	1 = if more is collected from woodlot as a results of PFM, 0 otherswise
Collect1	1 = no collection permitted before or after CBFM, 0, otherwise

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