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Research Article

Livelihoods and Welfare Impacts of Forest Comanagement

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Comanagement programmes are gaining popularity among governments as one way of improving rural livelihoods. However, evidence of their effects on the livelihoods and welfare remains unclear. We used the sustainable livelihoods framework and stated preference techniques to assess the livelihoods and welfare impacts of forest comanagement on 213 households in Zomba and Ntchisi districts. The results show that approximately 63% of respondents perceive that, overall, comanagement has had no impact on their livelihoods. However, the programme is enhancing financial capital by introducing externally subsidised income generating activities and human and social capital among some community members through training programmes. A majority of households (80%) are willing to pay annual membership fees to participate in the programme (mean = 812 Malawi Kwacha), because of perceived potential future benefits. Education, gender of the household head, a positive perception of current livelihoods benefits, and a position on the committee increase household willingness to pay membership fees. However, the positive willingness to pay despite the negative perception of overall livelihoods impacts may also demonstrate the weaknesses of relying on stated preference surveys alone in estimating welfare effects.

1. Introduction

Forest comanagement approaches are promoted as one way of improving the livelihoods and welfare of rural communities [1]. However, the evidence for their livelihoods and welfare impacts has been found to be weak, due to limited rigorous impact evaluation studies [2]. Nevertheless, the approaches are gaining popularity and wider acceptance by governments and donors in the developing world as a prerequisite for conservation and development policies [3, 4]. The initiatives are also part of the larger economic and institutional reforms being pursued by many governments under IMF and World Bank lending conditionality since the 1990s [5]. Given this continued popularity, it is important to understand how comanagement affects the livelihoods and welfare of participating communities, to ensure effective and efficient implementation and resource allocation [1]. Therefore, using the case of a forest comanagement programme in government forest reserves in Malawi, we assess the programme's current livelihoods impacts and estimate its perceived welfare benefits among participating communities.

To assess the impact of comanagement programmes on livelihoods and welfare, we adopted the sustainable livelihoods framework, for example, [6–8], combined with a contingent valuation question (stated preference technique) to estimate household's "willingness to pay" (WTP) to participate in the programme, for example, [9]. The combination of approaches was essential for obtaining a comprehensive view of the livelihoods and welfare impacts, which would otherwise be difficult to achieve if each method was used on its own. For example, although stated preference techniques are widely used in valuing natural resource and environmental welfare benefits, due to their hypothetical nature they are vulnerable to hypothetical and strategic biases and do not provide explicit evidence for what a household has actually gained [10–12]. Furthermore, household WTP may

reflect either present welfare benefits accrued or expected future benefits [13]. Therefore, by using both the livelihoods framework and stated preference techniques, it is possible to externally validate the benefit estimated by the contingent valuation [14]. This combined approach is novel in the forest comanagement literature. Therefore, this paper makes a useful empirical and methodological contribution to the existing literature on the livelihoods and welfare benefits assessment and forest comanagement approaches.

2. Measuring Livelihoods and Welfare Impact

2.1. Sustainable Livelihoods Framework. Livelihoods have been defined as "means, activities, capabilities, assets and entitlements by which people build a living" [15–17]. Thus they comprise both material and social resources [15]. Therefore, when assessing livelihood impacts of development policies and projects, both economic and social aspects of human wellbeing should be considered [16]. The sustainable livelihoods framework developed by Department for International Development (DFID) [17] emphasises the role that development policies and programmes play in human social and economic wellbeing; hence it offers a logical point of reference for assessing forest comanagement programmes, because they aim at improving both the social and economic wellbeing of local communities [7].

The sustainable livelihoods framework highlights five capitals upon which livelihoods impacts can be assessed. These are natural, financial, physical, social/political, and human capital (Table 1). The framework emphasises that, for households to achieve positive livelihood outcomes, a range of capital categories are required, because no single category can sufficiently meet households' multiple and varied livelihoods needs [17]. Therefore, at a given time households may draw on the different capital base to pursue a range of livelihood strategies, so as to yield positive livelihoods outcomes [16, 17, 28].

A household's choice of livelihoods strategy is determined by the household's preferences and priorities, as well as trends (e.g., population and resources trends), shocks (e.g., droughts), and seasonality (e.g., shift in prices and employment opportunities), which are beyond their control [18]. Additionally, availability of and access to the different forms of capital are regulated by the existing transforming structures and processes (i.e., institutions and policies) [17]. Therefore, household livelihood strategies and outcomes are influenced by opportunities and capabilities to access and acquire capital within the context and dynamics of vulnerabilities, transforming structures, and processes [15]. Thus, although a comanagement programme is not a capital in itself, it has the potential to provide opportunities and capabilities for accessing the different forms of capital that forest and forest systems provide and support [19]. By using the opportunities, capabilities, and activities provided by the programme, households can develop livelihoods strategies that respond to their needs and constraints and eventually translate into positive outcomes [20]. For example, compared to state forest management, comanagement gives communities legal rights to access and use forests sustainably, hence potentially providing them with new livelihoods opportunities and sources [7]. Additionally, access to and sustainable use of forests can reduce the risks and vulnerabilities that local communities face, since forests resources are an important safety net in stress periods such as crop failure and drought [21]. Studies on livelihoods, for example, [8, 19, 22, 23], have identified and described various indicators for assessing opportunities and capabilities that those comanagement programmes can provide to communities in order to improve their livelihood (Table 2).

We assessed impacts on natural capital based on local people's perceived changes in the availability, quantity, and quality of forest resource stocks (i.e., timber trees, NTFPs, and improved forest conditions) and changes in access to forest resources. Impacts on financial capital were evaluated in terms of perceived changes in income sources, income levels, ability to access loans, employment opportunities, and ability to accumulate savings. We assessed physical capital at both community and household level (Table 2). At community level, we evaluated the differences in infrastructure developments (e.g., roads) before and after the programme was initiated, whilst at household level we identified the various assets that households have acquired because of their participation in the programme.

Currently there is no consensus on the indicators for measuring social capital, due to its multidimensional nature and ability to change with time and contexts [25]. Furthermore, DFID [17] suggest that measuring social capital may be difficult for an outsider and may require a lengthy analysis over time. Thus in an attempt to assess the impact of forest comanagement on social capital, we evaluate the degree of participation in communal activities (i.e., collective action and cooperation) before and after the programme started.

Although human capital comprises education, knowledge and skills, health, and food security, in this paper we present impacts on human capital based on perceived changes in training and knowledge development before and after the implementation of the programme [19]. The health aspect of human capital was excluded because direct impacts of forest comanagement activities on health are likely to be limited and difficult to quantify [8]. Furthermore, important elements of human health such as vaccinations and provision of health care are not part of the programme under study in Malawi [26]. Additionally, because different forms of capital are linked and can be converted into each other [17, 20], human capital in terms of food and nutrition can be reflected in the assessment of natural capital through changes in access to and availability of forest products including fruits and vegetables and financial capital through income effects. Therefore to avoid duplication and double assessment, food and nutrition were considered to be directly linked and reflected in the natural capital benefits in terms of access and availability of forest products.

Livelihoods are sustainable if they can cope with and recover from stresses and shocks and maintain or enhance the current and future capital base, without undermining the natural resource base [27]. As such households may use

Table 1: Livelihoods capitals and their definitions.

Capitals	Definition	Reference
Natural	(i) The natural resources and environmental services that form the basis for human survival and economic activities (e.g., forests, water, and pollution sinks)	[17, 24]
Financial	(i) Capital bases that enable a household to pursue particular livelihoods strategy (e.g., cash, credit, income, and savings)	[17, 25]
Physical	(i) Basic infrastructure (e.g., transport, communications), housing, and equipment of production	[17, 24]
Social/political	(i) Aspects of the society or community upon which households depend, when pursuing livelihoods strategies that require coordinated actions (e.g., networks, social relations, associations, norms, and trust)	[17, 25]
Human	(i) Skills, knowledge, labour, good health, and physical capability that enable one to pursue livelihoods strategies	[17]

Table 2: Indicators of forest comanagement opportunities and capabilities for the different livelihood assets.

Livelihood capitals	Indicators of comanagement opportunities and capabilities
Natural	(i) Improved availability of and access to forest resources: (e.g., timber, firewood trees, and poles)
Financial and income	(i) Increased livelihoods and income sources (ii) Increased income levels (iii) Access to loans (iv) Employment (v) Ability to accumulate savings
Physical capital	(i) Development projects (e.g., road building) (ii) Accumulation and acquisition of assets (e.g., land, house, household, and farm assets)
Social capital	(i) Friendly relationships and social organization (ii) Degree of participation in local communal activities (i.e., collective action and cooperation)
Human capital	(i) Training and knowledge development

different combinations of available capitals and activities in order to reduce their vulnerability to stresses and shocks [20, 24]. Thus, it is difficult to draw a conclusion on the overall impact of the comanagement based on the changes in the individual capitals alone [28]. Therefore, in addition to perceived changes in the different livelihoods capital indicators, local peoples' perceptions of the overall impact of the comanagement programme on their livelihoods were also sought.

2.2. Stated Preference Techniques: The Contingent Valuation Method. The contingent valuation method (CVM) is a survey-based stated preference technique used to value goods and services that are not traded on the market [29]. The approach uses hypothetical scenarios with a defined payment vehicle to elicit respondents' willingness to pay (WTP), which estimates the utility gained from the described service [9]. The underlying assumption is that although respondents are presented with a hypothetical scenario, their behaviour and responses reflect their behaviour in real situations [10]. We used the contingent valuation method, rather than choice experiments, because the study was not interested in exploring and valuing different attributes and levels of comanagement but rather valuing the existing programme as a whole [30].

Due to their hypothetical nature, stated preference surveys are prone to biases including hypothetical bias, strategic bias, and social desirability bias. Hypothetical biases arise when the hypothetical situation presented to respondents fails to reflect the real situation; as such the respondents do not consider budget constraint, and hence the resultant values usually overstate the real value [10]. We minimised the occurrence of hypothetical biases by using a payment vehicle common and familiar to our study communities and also by prompting the respondents to consider their budget constraint as they respond to the question [31]. Strategic bias occurs when respondents respond to the question with intent to influence the study outcome in their favour, if they believe that the hypothetical scenario may become a reality [11]. Social desirability bias, usually associated with face-to-face interviews, occurs when respondents give responses that they perceive as culturally acceptable or to be liked by the interviewer, with a desire to appear to relate to the socially desirable attributes of the programme [32]. To avoid strategic and social desirability biases, participants in our survey were made aware that the situation being presented to them is hypothetical and developed for the purpose of the study and was not directly connected to the programme implementers. However, in order to ensure that consent was informed, it was explained that the outcomes of the study would be made available to the programme coordinators for their reference. Other limitations of CVM surveys pertinent to this study include the difficulty in validating the estimated values externally and uncertainties associated with using the method in developing countries because of the low income and illiteracy of respondents [9]. However, despite the biases

and limitations, CVM surveys remain a useful method for estimating welfare impacts of environmental management policies in both developed and developing countries if it is properly designed [10–12].

3. Methods

3.1. Study Area. Zomba-Malosa and Ntchisi forest reserves are two of the 12 forest reserves where the Malawi Government is implementing the Improved Forest Management and Sustainable Livelihoods Programme (IFMSLP) through the Department of Forestry [33]. The programme aims to address forest degradation and poverty through promoting community involvement in the management of government owned forest reserves. The programme, which was in its 7th year at the time of the study, was implemented for 14 years from 2005 to 2014.

Zomba district is located in the southern region of Malawi and covers 2,580 square kilometres. Zomba-Malosa forest reserve is the only gazetted forest in the district and covers 15,756 hectares, consisting of Miombo woodlands and pine plantations. It is a catchment for major lakes and rivers in the country (e.g., Lake Malawi) and a significant source of water both for domestic and for agricultural use. The reserve is also a source of wood energy (charcoal and firewood) to households in the district as well as neighbouring districts. This has accelerated deforestation and degradation of the reserve. Additionally, the reserve is being encroached upon in the peripheral areas for settlement and agriculture, resulting in further deforestation.

Ntchisi district is located in the central region of Malawi and covers 1,655 square kilometres. Ntchisi district has 3 gazetted forest reserves, namely, Ntchisi, Kaombe, and Mndilasadzu forest reserves, with Ntchisi forest reserve being the largest covering 9,720 hectares. The reserve is located in a remote and rural part of the district, approximately 32 km from the district centre. The reserve is a source of nontimber forest products including mushrooms and edible caterpillars and water for communities living around the reserve. Tree cutting in search of edible caterpillars is said to be a significant cause of deforestation and degradation in the reserve.

3.2. Data Collection

3.2.1. Questionnaire Survey Design and Procedure. Prior to the household survey, pretesting was done in order to assess the acceptability of the payment vehicle and the response rate to the open-ended CVM question. A total of 20 households participated in the pretesting survey, conducted with communities living around the Dzalanyama forest reserve, in Lilongwe. These communities were participating in a community forest management programme, but not under the IFMSLP. Before the start of each survey session, focus group discussions with community members and key informant interviews with members of the committee, traders and representatives of the community-based organizations, were conducted in each study community to gather general information about the programme and its impacts on livelihoods. A systematic random approach was used in selecting the households to participate in the survey interviews, from a village register provided by the communities' village heads. The village list formed the sampling frame from which every fourth household on the list was selected to form part of the study. A total of 213 household heads in participating study communities were interviewed (114 in Zomba-Malosa, 99 in Ntchisi), representing approximately 32% of the total household population in the selected study communities.

3.2.2. Socioeconomic and Livelihoods Questionnaire. The questionnaire first gathered the socioeconomic characteristics of the respondents, including age, education, location, income source, and wealth indicator. Key informants and focus group participant revealed that households' house or dwelling characteristics, that is, type of walls, roof, floor, and window, can reflect the wealth status of an individual or household. Following this information, different parts of a house or dwelling were assigned a score depending on the type of material they are made from, with 1 being the lowest score and 4 being the highest score. Hence household wealth indicator was created based on aggregate scores assigned to different household characteristics. Wealth indicator ranged from 4 to 11, with a score of 4 representing the poorest and 11 being the richest household.

Household socioeconomic characteristics were tested as predictors for (1) perceived overall programme impact and access to programme benefits and (2) households' responses to the contingent valuation question, in order to determine benefit distribution across community members and factors affecting access to benefits. Respondents were also asked to indicate their perceived changes in the different livelihood capitals before and after the programme was initiated (Table 1) and the programme's current overall impact on their livelihoods (i.e., whether they were benefiting or not). The response to perceived current overall impact on their livelihoods was also tested as a determinant for the households' WTP.

3.2.3. Contingent Valuation Survey. We used annual membership fee as a payment vehicle to elicit household willingness to pay values for forest comanagement programme. Many individuals in the study area belong to small village groups (e.g., village banking group, irrigation farming groups), to which they are required to pay an annual membership fee, to show commitment. Therefore, respondents are familiar with the payment vehicle adopted, hence minimising the occurrence of hypothetical bias. The hypothetical scenario was presented as follows:

> *Imagine that the Government and its partners will no longer be in a position to fund some of the activities of the programme, thus they would like to ask each community member to contribute in the form of a membership fee, so as to ensure that the activities of the programme continue in the community.*

After presenting the payment vehicle, respondents were allowed to ask questions to ensure that they had understood the scenario, before presenting them with the WTP questions. The questions asked by the majority of the respondents with regard to the payment vehicle were (1) what will the money be used for, and who will use it? and (2) will payment translate to increased access to forest resources? This reflects that respondents were able to understand the questions and process the issues and constraints as they would in a real situation before making a payment decision.

Following presentation of the hypothetical scenario, respondents were asked whether or not they would be willing to pay a membership fee. If the response was "no," they were asked to give reasons for their response, and the interview was terminated. All such responses were considered as zero WTP. If the respondents answered "yes," they were then asked how much they would be willing to pay per year. An open-ended question was used because (1) it would have been impossible to have sufficient sample size within forest comanagement implementing communities for a dichotomous question; (2) during the preliminary survey we observed that respondents did not have problems in stating the WTP amount since the payment vehicle is common and familiar to most communities; and (3) being a heterogeneous community open-ended questions provide more information on WTP that would enable us to assess the credibility of the responses [34].

3.3. Data Analysis

3.3.1. Probit Model. A probit regression model was used to explore factors that predict whether households (1) perceive positive overall livelihoods impact of comanagement, (2) accessed new income sources initiated by the programme, and (3) were willing to pay membership fees to participate in forest comanagement. According to Wooldridge [35] the probit model equation is specified as

$$\Pr(Y = 1 \mid X) = \Phi(X\beta), \quad Y = \{1, 0\}, \tag{1}$$

where Y (dummy variable) is equal to 1 for households giving a positive response and zero if otherwise. Φ is a cumulative density function, X are household and individual characteristics, and β are parameters to be estimated.

3.3.2. Ordinary Least Square (OLS) Regression and Tobit Regression Model. Factors affecting open-ended WTP estimates can be explored using Ordinary Least Squares (OLS) regression. However, the use of OLS regression might lead to biases in parameter estimates and misleading inferences depending on the number of zero WTP responses in the data set [35, 36]. If zero responses are excluded, the use of OLS on the censored data set may also result in sample selection bias, as the remaining data with positive WTP only is unlikely to be a random sample, even if the initial sample (all included) was random, and as such it may provide inconsistent parameter estimates [35]. Therefore, in case of relatively large numbers of zero WTP, the censored regression model, known as Tobit, is the theoretically preferred model [36]. A Tobit model with selectivity allows decomposition of the data set to examine more closely the effects of the independent variables on positive WTP observations [36]. However, so far there is no clear guide in the literature as to what number of zero WTP observations require the use of Tobit regression in place of OLS. Therefore both OLS regression (including the zero WTP) and Tobit regression (censored at zero WTP) results are presented in this paper.

The general description of the OLS model is

$$Y^* = X_i\beta + \varepsilon_i, \quad \varepsilon_i \approx N\left(0, \sigma^2\right), \tag{2}$$

where Y^* is the amount that the household indicated that they are willing to pay. OLS regression assumes that the dependent variable Y^* is linear and continuous. X are characteristics of the household and the head of household and β are parameters to be estimated. The error term ε is assumed to be normally distributed with mean zero and variance σ^2. The Tobit model follows the OLS regression equation; however, the observed willingness to pay (Y^*) represents the latent variables censored at WTP greater than zero. Therefore the Tobit equation follows:

$$Y_i^* = X_i\beta + \varepsilon_i, \quad Y_i = \begin{cases} Y_i^* & \text{if } Y^* > 0, \\ 0 & \text{if } Y^* \leq 0. \end{cases} \tag{3}$$

For both the OLS and Tobit regression models, the dependent variable is the annual amount households are willing to pay as a membership fee, measured on a continuous scale. The Variance Inflation factor (VIF) scores were less than 10 and Tolerance scores ranged from 0.64 to 0.91, indicating weak correlation between the explanatory variables [37]. For all the regression models, bootstrapping (1000 resamples) was used in estimating the coefficients, to correct for any distributional and asymptotic errors and to ensure that the results are valid, accurate, and closer to the population parameters [35]. Data were analysed using STATA version 11.2.

4. Results and Discussion

4.1. Perceived Forest Comanagement Livelihoods Impacts. Approximately 43% (Zomba-Malosa) and 28% (Ntchisi) of the respondents perceive that the comanagement programme has had or is having a positive impact on their livelihoods and approximately 57% (Zomba-Malosa) and 71% (Ntchisi) perceive that the programme has had no impact on their livelihoods. This difference in number of households perceiving a positive impact and those perceiving negative impact could suggest inequalities or elite capture in benefit sharing. This support the findings in [38] that found that a majority of participants in comanagement programme, in Malawi, perceive benefit distribution as unfair and that only a few influential members of the community, for example, committee members and chiefs, share the benefits.

A majority of respondents, 76% (Zomba-Malosa) and 73% (Ntchisi), perceive that the availability and accessibility of firewood and timber trees have reduced since the programme started (Table 3). This could be attributed to small levels of harvestable stock in the forest reserves due

Table 3: Perceived livelihoods status before and after comanagement programme in Zomba-Malosa and Ntchisi.

Livelihoods capitals	Indicators	Percentage response by district				Notes
		Zomba-Malosa (n = 106)		Ntchisi (n = 99)		
		Before comanagement	After comanagement	Before comanagement	After comanagement	
Natural capital	Better availability of and access to firewood and NTFP	55	24	51	27	
	Better availability of and access to timber and pole trees	56	33	71	19	
Financial capital	Accessed loans	5	35	0	30	Village banks initiated by the programme
	Saving	7	39	3	24	
	Access to new income sources	N/A	31	N/A	32	
	(i) Wage labour	N/A	43	N/A	17	During firebreak and forest road constructions
	(ii) Forest based income generating activities	N/A	19	N/A	70	Transport, initial inputs, and materials provided by project
	(iii) Irrigation agriculture	N/A	39	N/A	14	Perceived improvements in water flow due to improved forest condition
Physical capital	Have acquired assets	N/A	36		29	Through participation in wage labour or forest-based business initiated by the programme
Social capital	Participation in communal activity	10	39	20	49	
Human capital	Training and skill development	12	76	15	63	

to the general declining trend in forest resources over the years. Furthermore, tree populations take time to respond to new management approaches [7]; hence the period of comanagement implementation at the time of the study (7 years) would not have been long enough to allow forest rehabilitation to a level yielding adequate harvestable stock. Nevertheless, approximately 32% (Zomba-Malosa) and 24% (Ntchisi) of respondents attributed the reduction in access to forest resources to the strict laws and regulations being enforced under the comanagement programme (under the comanagement programme, the forest reserve is divided into coupes to facilitate selective tree forest resources harvesting; harvesting is done following the strict harvesting and management plans, rules, and regulation; the strict laws and regulations include selective harvesting of trees for timber, only collecting dead wood for firewood, and harvesting of both timber and nontimber forest products should only be done upon acquisition of permit from the management committee at a cost; furthermore, noncompliance with the laws and regulation attracts sanctions and penalties, e.g., community work or fines [38]). Since noncompliance with the laws and regulation attracts sanctions and penalties, for example, community work or fine [38], thus to avoid penalty communities comply. Furthermore, harvesting permits are obtained upon paying a loyalty fee, which might be costly for the rural poor with limited disposable income, thus reducing their access to forest resource. Therefore, the perceived reduction in access to and availability of forest resources is a result of both comanagement (i.e., strict accessing rules and regulations) and preexisting poor forest condition. The strict enforcement of rules and regulations is necessary to allow for the regeneration of the forest [26]; however there is a need for balance so that the achievement of community livelihoods goals is not constrained.

Approximately, 31% (Zomba-Malosa) and 32% (Ntchisi) of respondents indicated that the programme has helped them to attain new income sources, such as (a) wage labour during firebreak construction and maintenance; (b) income generating activities, for example, timber sales, firewood sales, pottery (clay pots) sales, bee-keeping, and mushroom farming; and (c) indirect benefits in the form of dry season irrigated agriculture (Table 3). Similarly, there was an increase in the number of households accessing loans and saving in the local village banks since the programme started.

The estimated amount in annual savings ranged from MK 500 (US$ 1.7) (the exchange rate at the time of study was Malawi Kwacha (MK) 288.7347 = US$ 1) to MK 10000 (US$ 34.4) in Zomba-Malosa and MK 500 (US$ 1.7) to MK 6000 (US$ 20.8) in Ntchisi district. The loans are linked to the programme's enhancement of social capital within the participating communities, as the loans are accessed from a local community bank initiated by the programme. Additionally, 31% (Zomba-Malosa) and 32% (Ntchisi) of the respondents have accessed new income sources (e.g., wage labour and forest-based business groups initiated by the programme). Thus approximately 36% (Zomba-Malosa) and 29% (Ntchisi) of the respondents indicated that they have managed to acquire assets (e.g., household utensils, furniture, bicycles, and farm equipment) as a result of their participation in income generating activities initiated by the programme. However, the income generating activities that are being promoted in the area (e.g., firewood sale and pottery) are of low value [21], hence the minimal impact on household income levels. Also, it is important to note that the income generating activities are externally subsidised by the programme donors (e.g., initial transport to market), hence the current far-from-universal positive impact on livelihoods creates uncertainties for the programme's long term livelihoods impacts when the donor or external funding is withdrawn.

We observed that the programme's investment in physical capital at community level is limited. Both communities highlighted accessible forest roads as a major infrastructure development that they require. The communities were of the view that even if the forest reserves were to have significant high value timber trees, with potential to generate high revenue, the current poor roads would limit access to economically viable markets. This would limit the programme's potential to positively improve livelihoods, both during and even beyond its implementation period.

A majority of community members perceive that training and skill development activities have increased since the programme started (Table 3). Although the programme does not provide formal education, it contributes to the development of human capital, by facilitating training in forest and tree management techniques. The programme also facilitates and enhances the development of social capital through establishment of village committees and initiating regular community meetings, where issues relating to forest management and other developmental issues are discussed. The committee meetings allow for regular interaction with government forest staff and other stakeholders, hence increasing their social network base and ability to contribute to forest policies that affect their livelihoods [27]. Furthermore, social capital enhances human and financial capital among households since communities are able to form village banking groups and further access loans from the banks [38].

4.2. Who Has Benefited? The probability of perceiving a positive overall impact of comanagement on livelihoods is 89% higher for households in Zomba-Malosa compared to those in Ntchisi (Table 4, A) and 49% higher for households that perceive better access to and availability of firewood. Firewood and NTFPs are essential for day-to-day livelihood strategies for rural households in Malawi; therefore improved access to and availability of forest resources directly and positively affect households' livelihoods.

The results show that households that perceive increased participation in communal activities because of the programme are 34% more likely to perceive the overall programme impact as beneficial than those who did not (Table 4, A), therefore suggesting that communities not only measure perceived benefits in terms of economic benefits but also measure perceived benefits in social and noncash benefits, contrary to Phiri et al. [23] who suggested that communities perceive the benefits of forest comanagement programmes as minimal because they only measure benefit in terms of monetary or tangible economic benefit. Access to new income sources increases a household's probability of describing the overall programme impact as positive by approximately 92% (Table 4, A). This is expected because access to new income sources can potentially translate into increased income levels and improved livelihoods [3, 8]. Furthermore, new income sources may diversify household livelihood sources hence reducing household's vulnerability to shocks and stresses (e.g., failure in crop production) [24].

The income generating activities initiated by the programme are forest-based and group-based; hence it is plausible that the probability of accessing new income sources is higher for households that perceived better access to and availability of forest resources (30%) and better participation in communal activities (40%) (Table 4, B). Households whose head is a committee member is approximately 60% more likely to access new income sources and to perceive the overall impact as beneficial (Table 4, B). Although this raises questions about the equity of benefits sharing among community members, there is no further evidence from the probit model to suggest that access to new income sources is influenced by household characteristics or social status (e.g., wealth status, gender, and age). Lastly, access to new income sources is positively and significantly related to access to loans. This is expected as usually households opt for loans for investment purposes, for example, small businesses, rather than consumption [39].

4.3. WTP to Participate in the Forest Comanagement Programme

4.3.1. Are Households Willing to Pay a Membership Fee? Although a majority perceive that currently they are not benefiting from the programme, approximately 83% (Zomba-Malosa) and 81% (Ntchisi) of respondents are willing to pay membership fees to participate in the forest comanagement programme. The mean annual willingness to pay amount is approximately MK 1,000 (US$ 3.5) in Zomba-Malosa and MK 400 (US$ 1.4) in Ntchisi, respectively. These values are approximately five times (Zomba-Malosa) and two times (Ntchisi) the minimum daily wage rate (daily wage rate in urban communities is estimated at MK 200; however the Malawi Government Employment Act stipulates MK 98

Table 4: Probit regression result on factors affecting perception of programmes overall impact and accessing new income sources.

Covariates	Perceived overall impact A		Accessing new income sources B	
	Coefficients	Bootstrapped Std. errors	Coefficients	Bootstrapped Std. errors
District *(Ntchisi = 1; Zomba = 0)*	−0.89****	(0.25)	−0.24	(0.24)
Better access to and availability of timber *(1 = yes; 0 = no)*	0.06	(0.13)	0.32**	(0.13)
Better access to and availability of firewood *(1 = yes; 0 = no)*	0.49****	(0.14)	−0.18	(0.13)
Better training and skill development *(1 = yes; 0 = no)*	0.07	(0.15)	−0.21	(0.14)
Better participation in communal activity *(1 = yes; 0 = no)*	0.34**	(0.16)	0.40**	(0.18)
Committee member *(1 = yes; 0 = no)*	0.40*	(0.23)	0.687***	(0.21)
Acquired assets *(1 = yes; 0 = no)*	0.50*	(0.26)		
Accessed new income sources *(1 = yes; 0 = no)*	0.92****	(0.23)		
Accessed loans *(1 = yes; 0 = no)*	0.69	(0.81)	0.78*	(0.56)
Saving *(1 = yes; 0 = no)*	−0.14	(0.22)	0.19	(0.21)
Married *(1 = yes, 0 = no)*	0.09	(0.12)	−0.23	(0.13)
Gender of household head *(1 = female, 0 = male)*	−0.07	(0.23)	−0.33	(0.21)
Age of household head *(in years)*	−0.01	(0.01)	0.01	(0.01)
Household size *(number of adults and children)*	0.03	(0.05)	−0.10	(0.05)
Land size *(in hectares)*	0.09	(0.03)	0.02	(0.03)
Wealth indicator (*ordinal scale, 4–11*)	0.03	(0.06)	−0.03	(0.06)
_cons	0.04	(0.78)	−0.37	(0.71)
Prob > chi2	0.00		0.01	
Number	213		213	
Pseudo *R*2	0.24		0.14	
Log pseudo likelihood	−101.11		−110.57	

Significance levels (∗: 10%; ∗∗: 5%; ∗∗∗: 1%; and ∗∗∗∗: 0.01%).

as the daily wage rate in rural areas [40]) and represent approximately 6% (Zomba-Malosa) and 4% (Ntchisi) of the average estimated annual earning of the respondents (the estimated annual earning for respondents is MK 15000 in Zomba-Malosa and MK 9000 in Ntchisi). Considering that rural Malawi is characterised by high poverty levels, high unemployment rates, heavy reliance on smallholder agriculture, susceptibility to shocks, and limited disposable income such that 20% of the rural population struggle to even afford the daily recommended food requirements [41] (approximately 75% of Malawians live under the poverty threshold of under US$ 1.25 a day; 28% of the rural households (which is 85% of total population) are characterised as ultrapoor, with limited access to employment as 75% earn their living only from smallholder farming, and for those on wage employment the income is so minimal; hence the disposable income is very low; additionally people have limited or even no access to financial services such as credits, which further limits their economic growth and spending pattern [41]), the willingness to pay values represent a substantial proportion of households' annual income. This suggests that communities are optimistic about substantial future livelihoods and welfare benefits from the programme and thus willing to invest in the programme's activities. However, it is doubtful that communities will accrue positive livelihoods and welfare benefits from the programme in future (especially after withdrawal of external support), when it is failing to provide the majority with positive benefits at present, despite the externally subsidised income generating activities it is currently implementing. Therefore, it can be argued that the estimated willingness to pay is due to respondents' optimism (optimism bias) of future benefits that forest recovery could potentially provide. Interestingly, a majority of those not willing to pay in both Zomba-Malosa (87%) and Ntchisi (72%) attributed their decision to lack of benefits from the programme and lack of trust in the leadership with regard to financial accountability and inability to pay. Chinangwa [38] also observed a general lack of trust in leadership with regard to financial accountability among communities participating in forest comanagement programme in Zomba-Malosa and

Table 5: Factors affecting households' willingness to pay a membership fee to participate in comanagement programme in Zomba and Ntchisi districts.

	Probit model (WTP = 1)	
	Coefficients	Bootstrapped Std. errors
Perceived overall impact dummy *(1 = benefiting, 0 = not benefiting)*	0.43*	(0.23)
Wealth indicator *(ordinal scale, 4–11)*	0.11*	(0.08)
Number of years in school	0.07**	(0.03)
Committee member (1 = yes, 0 = no)	0.36*	(0.25)
Land size *(in hectares)*	0.03	(0.03)
District (1 = Ntchisi, 0 = Zomba)	0.17	(0.22)
Gender of household head (1 = female, 0 = male)	−0.20	(0.22)
Married (1 = yes, 0 = no)	0.07	(0.12)
Household size *(number of adults and children)*	0.03	(0.05)
Age of household head *(in years)*	−0.00	(0.01)
_cons	−0.82	(0.79)
Prob > chi2	0.02	
Number of observations	213	
Pseudo $R2$	0.10	
Log pseudo likelihood	−95.13	

Significance levels (∗: 10% and ∗∗: 5%).

Ntchisi, thus negatively affecting how they perceive and access benefit of the programme and consequently how they value the programme's welfare benefits relative to state management regime.

4.3.2. Factors Affecting Household Decision to Pay Membership Fee. The probit regression shows that households that perceive comanagement to have a positive impact on their livelihoods are 43% more likely to be willing to pay than those that perceive otherwise (Table 5), so as to secure continued livelihoods and benefit flows [9, 13]. An increase in households' wealth indicator by 1 point increases household probability for willingness to pay by 10% (Table 5). This suggests that wealthier households are more appreciative of forest comanagement and conservation, as they are less dependent on the forest for their livelihoods, than poor households. Furthermore, this shows that they are more able to invest in comanagement activities for the expected potential future benefits.

An extra year of schooling increases household probability of being willing to pay by 7% (Table 5). Mekonnen [9] suggests that more years in formal education enhance peoples' ability to understand and respond to the willingness to pay hypothetical questions. Therefore, the positive effect of schooling on willingness to pay may not necessarily indicate that educated people value the programme more than uneducated households but indicate that they understood the hypothetical question better. Committee members are more likely to be willing to pay to participate in comanagement (Table 5) because they are trained in forest management and in constant contact with forest staff and hence have a broader knowledge of the overall benefits of the programme and as such they are more appreciative of the programme. However, the committee member's likelihood of being willing to pay could be attributed to the greater benefits they access through programmes (e.g., Table 4, B). Furthermore, committee members' willingness to pay may be affected by social desirability bias, as they may view being willing to pay as an acceptable answer, since they are programme coordinators at community level.

4.3.3. Factors Affecting How Much Households Are Willing to Pay in Membership Fees. Although Halstead et al. [36] argue that the sign of coefficients estimated using Tobit analysis may differ from those estimated using OLS, we found no such differences, probably due to the small proportion of zero WTP (approximately 20%, [42]). Our results show no significant difference between the OLS and Tobit models except for the size of coefficients (Table 6).

Both the OLS and Tobit regressions suggest that respondents' district, wealth indicator score, gender of household head, and land size significantly affect households' decision on how much they are willing to pay (Table 6). Households in Zomba-Malosa *(mean WTP = MK 989 per year)* are willing to pay more than households in Ntchisi *(mean WTP = MK 400 per year)*. This may be attributed to socioeconomic variation across communities and how dependent the communities are on the forest for their livelihoods. For example, whilst an estimated 80% of the Ntchisi district economy and livelihoods are said to be agriculture based, it is estimated that 90% of Zomba-Malosa population are dependent on forests resources [35, 43]. Therefore it is plausible that communities in Zomba-Malosa are likely to be willing to pay more so as to secure their livelihoods and welfare flow.

An increase in households' wealth indicator by 1 point increases the WTP value by approximately MK 298 (OLS) or MK 412 (Tobit model). Households' WTP is associated with ability to pay [44]. As households' wealth status improves with increased income levels and asset base, they are likely to have disposable income and as such capable and likely to be willing to pay more for forest activities compared to poorer households [45]. Similar trends have been observed by Chikwuone and Okorji [44], for forest management in Nigeria.

Female-headed households are willing to pay approximately MK 298 (OLS) or MK 610 (Tobit model) less than male-headed households. Due to cultural norms, female-headed households in rural Malawi have limited access to forest management programme's financial benefits and resources [46]; thus the limited welfare benefits from the programme could be reducing their willingness to pay and value of the programme. This is in contrast to findings by Chikwuone and Okorji [44], who show that female-headed households are likely to be willing to pay more for community forestry compared to male-headed ones, because women

Table 6: Factors affecting how much households' willingness to pay a membership fee to participate in comanagement programme in Zomba and Ntchisi districts (in Malawi Kwacha).

	OLS model		Tobit model	
	Coefficients	Bootstrapped Std. errors	Coefficients	Bootstrapped Std. errors
District (1 = Ntchisi, 0 = Zomba)	−697.60**	(304.77)	−646.07**	(347.16)
Household size *(number of adults and children)*	−11.56	(44.93)	−26.00	(56.93)
Wealth indicator *(ordinal scale, 4–11)*	298.69**	(132.17)	412.54**	(191.84)
Gender of household head *(1 = female, 0 = male)*	−520.47**	(322.91)	−610.48**	(−587.61)
Number of years in school	−15.41	(73.70)	−32.15	(79.03)
Married *(1 = yes, 0 = no)*	146.18	(128.76)	210.23	(152.19)
Age of household head *(in years)*	−4.66	(17.73)	−11.26	(21.29)
Committee member *(1 = yes, 0 = no)*	−366.79	(269.37)	−280.87	(318.15)
Land size *(in hectares)*	60.59*	(35.10)	89.54*	(48.23)
Perceived overall impact dummy *(1 = benefiting, 0 = not benefiting)*	172.68	(338.46)	333.89	(421.54)
_cons	−15.13	(690.11)	−1479.25	(1293.83)
sigma_cons			2736.98****	(831.17)
Prob > chi2	0.01		0.02	
Number	213		213	
R-squared	0.07			
Root MSE	2435.68			
Pseudo *R*2			0.01	
Log likelihood			−1599.19	

Significance levels (∗: 10%; ∗∗: 5%; and ∗∗∗∗: 0.01%).

depend on forest resources for their livelihoods more than men. However it is plausible to argue that female-headed households have limited access to benefits and lower income levels and are more prone to risks and uncertainties in terms of income sources compared to male-headed households [47], hence likely to be willing to pay less than male-headed household.

The amount households are willing to pay is significantly and positively related to land size (Table 6). This could be because households with small land holdings may be encroaching into the forest to increase their land holdings and hence may not be engaged or interested in the conservation activities under comanagement, as they may be viewed as conflicting with their individual goals. Similar findings were found by Chinangwa [38] who observed that households with bigger land sizes are more likely to perceive forest conservation as criteria for measuring success of forest comanagement programme, compared to those with small land holdings in Malawi.

5. Conclusion

The findings of this study suggest that forest comanagement programmes can potentially improve household livelihoods by introducing profitable income generating activities; facilitating local lending and savings; enhancing social capital; and development of human capital through training. The positive effect on a household's likelihood of accessing new income sources from the programme when the household head is a committee member, coupled with the positive effects on household's WTP by households land holding sizes and wealth status, suggests that access to and distribution of programme benefits may be affected by households' socioeconomic status. Livelihoods diversification away from traditional agriculture through access to new forest-based and non-forest-based income sources could reduce household's vulnerability to stresses and hence eventually result in protection of the forest resources through reduced pressure and increased management and conservation activities by the participating communities. However, these efforts should be complemented with investment in physical capital and financial incentives, at community level, to enable community members to access economically viable markets and ensure that the programme's impacts are sustainable beyond the programme. The impacts of forest comanagement programmes often take a long time to materialise because there is a need to reestablish the condition of the forests to yield harvestable stock, as well as the need to develop effective management practices that are appropriate to the needs of the community. Therefore, although the current livelihoods impacts of the programme are minimal, this does not imply that the comanagement programme is a failure.

There is a potential for better or higher livelihood benefits from the programme in future, if proper management and utilization strategies are followed. The management and utilization strategies could include adherence to the selective tree harvesting and implementing afforestation programme and development of explicit user rights and benefit sharing procedure. Furthermore, to enhance accountability in management and utilization, public hearing and audit session should be introduced.

Although the livelihood impacts of comanagement are currently minimal and restricted to a subset of the community, community members may be willing to pay a membership fee to participate in a forest comanagement programme because of their perceived future benefits of the programme. This also demonstrates the danger of relying on stated preference surveys alone to estimate welfare effects, because the WTP values given by respondents could represent a number of things and may not always reflect respondents' present gains from the policy change or programme. Furthermore, this shows that community's investments of time and labour in the forest comanagement programme could be based on an overly optimistic view that in future the net welfare benefits from the programme will increase, which puts them at a risk of being taken advantage of by programme initiators in setting up CFM projects. Therefore, although contingent valuation methods remain important in estimating the economic value of environmental management policies like comanagement, the sustainable livelihoods framework seems more reliable at representing the real current impacts or benefits of comanagement on community livelihoods. Given the paucity of empirical evidence on comanagement, this paper makes useful empirical and methodological contributions towards the evidence base of forest comanagement livelihoods impacts that are likely to be applicable to other comanagement projects and studies as well as to other forms of CBFM initiatives at regional as well as global level.

Competing Interests

The authors declare that there is no conflict of any form regarding the publication of this paper.

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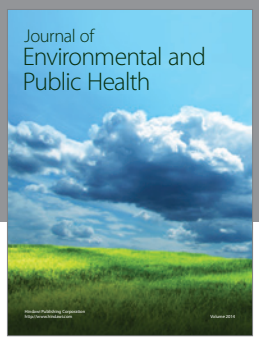

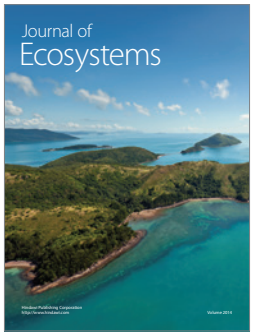

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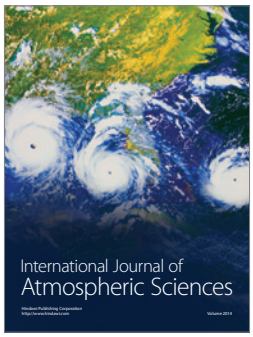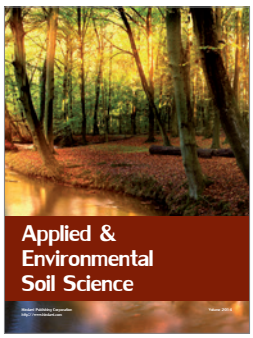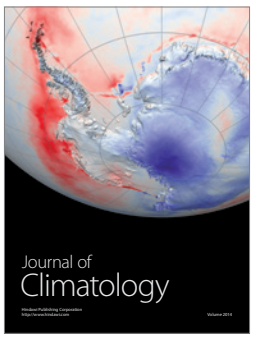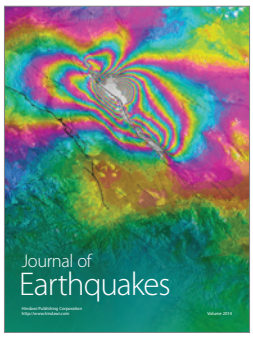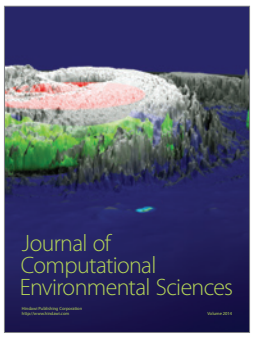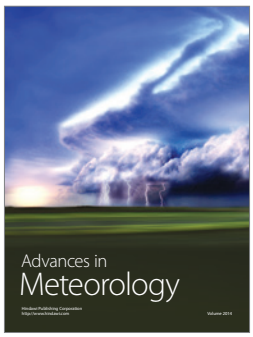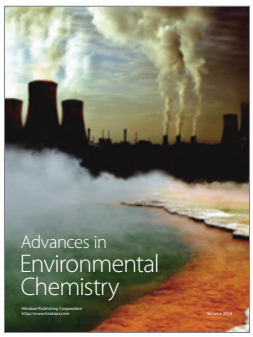
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