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What Explains Collective Action in Forest Management? Evidence from Benishangul Gumuf Region, Ethiopia

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Abstract
This study examines factors that influence collective action in the lowland bamboo forest of Benishangul Gumuz region. The study is based on data obtained from randomly selected 384 households. Descriptive and econometric models were used to analyze the data. After controlling for heterogeneity among households, we find strong substitution opportunities across collective action initiatives. The result shows that that participation in NRM is significantly influenced by factors, such as agro-ecology, settlement condition, households' income, networking, and households' perceptions towards group size. Whereas sex of household head, forest property rights, and gross income earned, heterogeneity and networking are the most important factors determining participation in hazard management. Indeed, sex of the household head, property rights, and networking capacity were found to be the important determinants of participation in information provision. These findings support the need to strengthen collective action institutions to manage local bamboo forest resources. Moreover, the results suggest the need for a diagnostic approach in the analysis of collective action in diverse socioeconomic and ecological settings.

1. Introduction

Since natural resources involve large numbers of resource users, their management often requires coordination of the users' actions, or collective actions. Collective action is an important mechanism for coordinating individual resource users toward achieving socially accepted outcomes by assigning management responsibilities that could correspond with simple and complete ownership rights (Bwalaya, 2004). Hence, institutional economists suggest collective action for effective management of natural resources (Berhanu *et al*., 2000; Nagiado and Kirk, 2000; Knox and Meinzen-Dick, 2001; McCarthy *et al*., 2002; Meinzen-Dick and Di gregorio, 2004; Mwangi, 2005). However, effective collective management and resource governance depends on existing institutional and organizational arrangements and their performance to ensure equitable access and utilization of the available resources (Bekele *et al*., 2009). According to these studies, institutional arrangements require rules and regulations for management and governance of community assets and structures and mechanisms for conflict resolution, regulation of behavior and agreed norms for sharing costs and benefits.

In the Ethiopian context, collective action is not a new phenomenon. It is an age-old tradition that runs through the history of Ethiopian society (Dercon *et al*., 2008). Since the beginning of human society individuals have found advantages of working together and helping one another; first in foraging, then in hunting, later in agriculture and still in manufacturing (Krishnaswami, 1992). Recent studies also indicated that most local people are encouraged towards establishment of cooperative societies in order to take some government policies and program advantages. Since management of common property resources like forest requires collective action therefore its effective and efficient in management and utilization of common pool resource was examined.

2. A framework for institutional analysis of common pool resources

In linking property rights, collective action, and natural resource management scholars mainly use two types of conceptual frameworks. These are: Institution for sustainability framework and institutional analysis development framework. However, the Institutional Analysis Development (IAD) framework presented in figure 2 below has been widely used in diverse issues since recent decades (Ostrom *et al*., 1994). In addition to the previous comprehensive framework, for the purpose of this research Institutional Analysis Development (IAD) framework which is developed in1970 by Ostrom and her colleagues was used to examine the relationship between property rights, collective action institutions and bamboo forest degradation. The Indian scholars used have used IAD framework to analyze both the simple arenas that are amenable to specifying a formal game (Ostrom, 2007). And in India, Imperial (1999) also suggested the use of IDA framework to understand institutional arrangements to implement on eco-system based management of natural resources. Recently, a few number of scholars in Ethiopia (Bekele, 2008, Fekadu, 2008, and Yemiru, 2011) used the IDA framework with some modification in accordance with the nature of their studies.

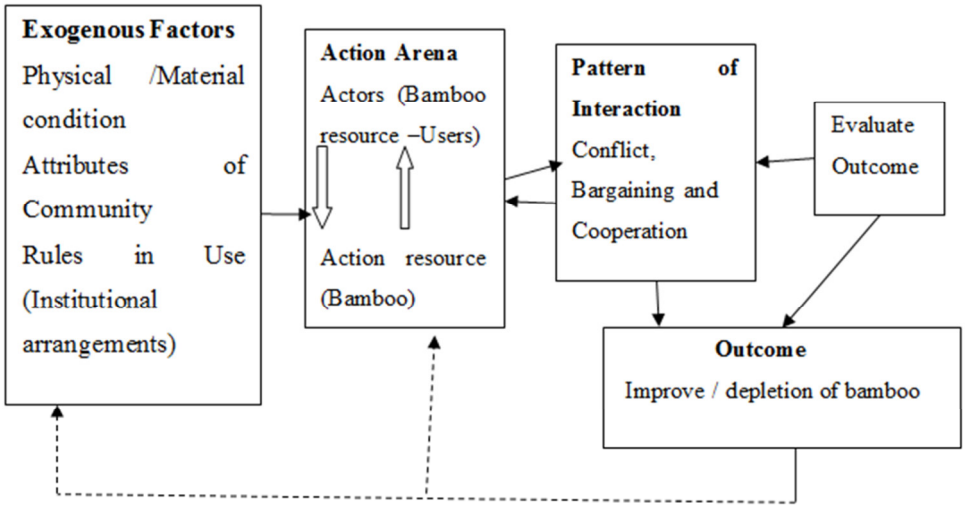
Broadly, three "exogenous" sets of variables are included in institutional framework analysis. These include: (1) the biophysical world, (2) the broader community of the participants themselves, and (3) the rules-in-use. To

make the analysis quit clear and more understandable, the framework is modified in the following ways (see figure 2 below). In this case, physical condition refers to the biological condition in which the local households live. It includes the natural resource condition (type, condition of forest, land, availability of wild animals, on which the households depend for their livelihood sustenance. Social infrastructural conditions like road, access to education, water, heath, electricity which is linked with livelihood conditions of the households are also included under this category. Household asset endowment: They are categorized in two main groups. These are tangible and intangible assets. Tangible assets refer to objects, such as livestock, human labor, forest, land and the like while intangible resources including indigenous skill and knowledge, culture, tradition, access to information, social capital, and other invisible assets which influence the household behavior in relation to bamboo deforestation. Community characteristics are attributes of community that affect behaviors of human interaction, such as homogeneous of local community, size of the community and capacity of local community in managing a local owned resource in a sustainable manner are included. Institutional arrangements (rules of the game) refer to the prescriptions that define what actions are required, prohibited or permitted, and the sanctions authorized if the rules are not followed (Crawford and Ostrom, 1995).

The term *action arena* refers to the social space where individuals interact, exchange goods and services, solve problems, dominate one another, or fight (among the many things that individuals do in action arenas (Ostrom *et al*., 2005). It consists of action situation and actors. More explicitly, it shows how multiple actors, including individuals, states, and organizations, make use of and change institutions to reduce bamboo forest degradation. Action in my case refers to conflict, bargaining and cooperation. However, for the purpose of this study conflict between the actors such as investors, refugees, and local community were considered. Cooperation of local people can be reflected in different ways. Household preference for cooperation was reflected by bamboo seed collection, fire protection, and provision of information to village leaders about illegal bamboo harvesters which are considered as indicators of cooperation for natural resource management.

In an action situation, actors make choices and follow strategies based on their action resources, the rules that define the action arena, and the attributes and expectations about the behavior of other actors involved. These choices create patterns of interaction which in turn produce outcomes. If these outcomes are positive for all actors involved, they maintain the structure of the action situation. However, if the outcomes are not positive for some or all actors, they try to change their strategy in the action situation using their bargaining power, which is shaped by their context. The outcomes of action situations, which are of a particular interest in the analysis, can be distinguished between structural outcomes, which affect the existing context, including property rights and collective action institutions, and "bamboo forest depletion/improvement," which directly affect the conditions of the people.

Figure 1: Framework for institutional analysis of common property resources management



Source: Adapted from Ostrom et al., 1994

3.2. Data Types and Source

The data for the study were obtained from both secondary and primary sources. The primary data were collected through questionnaire using face to face interview with sample households. The other primary data sources are group discussions with local farmers, forest management cooperative members organized by FARM-Africa, Bamboo Star Agro-forestry employees, and natural resource experts from *woredas*, Zonal and regional offices.

Sampling technique

This study employed both purposive and stratified multistage random-sampling technique in selecting 384

sample households.In the first stage, all the 21 *woredas* in the region were categorized into two groups: districts with bamboo forest (13 *woredas*) and without bamboo forest (the remaining 8 *woredas*). *Woredas* with bamboo resources were also classified into two as (*woredas* with lowland bamboo and with highland bamboo) based on bamboos species found in their respective *woreas*. Lowland bamboo is found in 11 *woredas*. Those districts with lowland bamboo resources are situated in two agroecologies (*kolla* and *woynadega*) were stratified in to two. The rational for stratifying *woredas* based agroecology is because of differences in terms of bamboo resource endowments owing to human and natural factors. Therefore, districts with lowland bamboo resources were further categorized into two strata based on their agroecologies. After listing all *woredas* in each agroecology, Assosa and Bambasi from first stratum (*woynade*ga agroecology); and Homosha and Guba *woredas* from the second stratum (*kolla* agroecology) were randomly selected.

Then, *kebeles* (the lowest administrative unit in Benishangul-Gumuz region) were classified into two groups. These are *kebeles* with and without bamboo resources as some *kebeles* did not possess bamboo resources. Subsequently, a total of 11 *kebeles* that possess bamboo resources were purposively selected. The selection of *kebeles in Assosa and Bambasi* was underpinned by the fact that these sample *kebeles* possess wider bamboo forest, but with high population pressure and high bamboo deforestation. Moreover, experts, NGOs, and regional authorities' opinions were also considered in selecting the *kebeles*. Accordingly three *kebeles* namely Afasisim, Yambasisim and Amba14 from Assosa *woreda* and three *kebeles:* Amba 46, Amba 47 and Amba 48 in Bamabasi *woreda* were purposively selected. Finally, Tumet, Dunga and Angela *kebeles from Homosha woreda,* and Ayicid and Beshat *kebeles* from Guba *woreda* were also purposively selected due to illegal bamboo export to Sundan, and high rate of bamboo depletion. According to the regional official report, bamboo smuggling has been commonly practiced in these five *kebeles* as they share boarder with Sudan and South Sudan. Thus a total of eleven *kebeles* were purposively selected from the four sample *woreda.*

Table 1: Population distribution in each *woreda/kebele* and sampled households

Sample *woredas/kebeles*	**Total *woreda/kebele* population**	**Sampled respondents**		
		Male	Female	Total
Assosa	**87,366**	**86**	**35**	**211**
Amba14	1156	30	12	42
Afasizim	950	33	13	46
Yambasizim	900	23	10	33
Bambasi	**40,129**	**74**	**31**	**105**
Kebele46	2392	26	12	38
Kebele47	1877	24	9	33
Kebele48	1928	24	10	34
Homosha	**21,502**	**70**	**17**	**87**
Angela	1092	26	6	32
Dunga	1510	30	5	35
Tumet	1418	14	6	20
Guba	**14,901**	**63**	**8**	**71**
Aycid	1100	30	3	33
Beshat	1010	33	5	38
Total *woreda* pop	**136,898**	**293**	**91**	**384**

Source: *Woreda* Agricultural offices, 2014

3.3.3. Data Analysis

Multinomial probit (MNP) modeling. Multinomial probit model was applied to estimate household heads' choice on the types collective action (categorical outcomes) as a function of exogenous factors. It has been recognized by many econometricians that the multinomial Logit (MNL) model is not appropriate when the assumptions of independent and identically distributed error term is violated. Alternative models like the hierarchical logit (HL) and nested logit model are proposed to deal with the problem of correlation among outcomes but only the multinomial probit (MNP) model is free from all deficiencies (Greene, 2012). It is interesting to mention that although the MNP estimation is more plausible compared to MNL model; it has shyly incorporated into practice. Hence, in this study, a multinomial probit model is utilized in order to determine factors that influence the probability of falling into each of this category.

According to Madalla, (1983) and Wooldridge (2008), multinomial logit (MNL) model has the following advantages. First it permits the analysis of decisions across more than two categories, allowing the determination of choice probabilities for different categories. Second, it is easy to compute the choice probabilities, and simple to interpret the estimates. However, it has crucial limitation. The major limitation of this model is the independence of irrelevant alternatives (IIA) property, which states that the ratio of the probabilities of choosing any two alternatives is independent of the attributes of any other alternative in the choice set (Hausman and

McFadden, 1984). Suppose Y_i be a random variable representing the participation decision chosen by a household. Three participation decisions are traced. (1) participation in natural resource management practice (agroforestry, bamboo seed collection and plantation (2) participation in risk avoidance (bamboo forest fire control and other disasters) and (3) participation in information provision to forest committee i.e. forest task forces and local leaders (control illegal charcoal producers, young bamboo shoot harvesters, over grazing and other illegal activities).

As elaborated, the three participation choices are not mutually exclusive. That means a household may simultaneously choose two or all of the choices. For example a household deciding to participate on management practices may also participate in risk management and/or in providing information. In such mutually inter-related outcomes, multinomial logit model result in biased estimate. Alternatively, the multinomial probit model (MNP) provides the most general framework for inter-dependent alternatives in discrete choice analysis, with normally distributed error terms (Ben-AKiva and Bolduc, 1996). This implies that MNP relaxes IIA assumptions. In these multiple choices, an individual household with a given set of characteristics facing three set of alternative outcomes, chooses the alternative that maximizes his utility. The following structural equation is illustrated based on utility maximization function, denoted with the following utility function model.

$$\mathrm{U_k} = \max(\mathrm{Uj})\ \mathrm{j} = 1,..\mathrm{Z} \tag{8}$$

Where *U* is the utility of participation in collective action, and the utility derived by a given individual from three types of participation is given by

$$\begin{aligned} U_1 &= X_1 b + e_1 \\ U_2 &= X_2 b + e_2 \\ \mathrm{U_3} &= \mathrm{X_3 b} + \mathrm{e_3} \end{aligned} \tag{9}$$

$X's$ are the independent variables influencing each outcome in the form of matrix notation, $b's$ are parameter to be estimated and $e's$ the disturbance term. Accordingly, participation decision in collective action, and the probability of choosing option Y_i and the set of explanatory variables. Mode 1 is chosen if *U*1 > *U*2 > *U*3 and vis-versa. These decisions are actually depend on a number of socioeconomic characteristics, institutional and other additional factors. Accordingly, the participation decision in collective bamboo forest management and the probability of choosing option Y_i and the set of explanatory variables X is specified as

$$\begin{aligned} Y_i^{1*} &= \beta_0 . \mathrm{X_i} + e_1 \\ Y_i^{2*} &= \beta_0 . \mathrm{X_2} + e_2 \\ &\cdots\cdots\cdots\cdots \\ Y_i^{m*} &= \beta_0 . \mathrm{X_m} + e_m, \text{ where } e \sim N(0, \Sigma) \end{aligned} \tag{10}$$

Then

$$y_i = \begin{cases} 1 & if \quad Y_i^{1*} > Y_i^{2*}, \ldots \ldots Y_i^{m*} \\ 2 & if \quad Y_i^{2*} > Y_i^{1*}, Y_i^{3*}, .. Y_i^{m*} \\ \ldots\ldots\ldots\ldots\ldots & \\ m & otherwise \end{cases} \tag{11}$$

Multinomial probit model is different from multivariate probit model, which is used to model correlated binary outcomes for more than one dependent variable. The marginal effects measure the expected change in probability of a particular choice being made with respect to a unit change in an explanatory variable (Long, 1997; Greene, 2000).

3. Results and Discussions

3.1. Descriptive statistics

Three types of bamboo forest are identified in the study *woredas:* These include: protected bamboo forest locally called as *Tibik Den*, private bamboo forest, and community bamboo forest. *Tibik Den* refers to the natural bamboo vegetation which is identified, demarcated, mapped and protected by government bodies. On the other hand, private bamboo forests in the area are referred as non-natural bamboos. These are plantations protected, managed and utilized by individual farmers, who hold private secure property rights. The third type of bamboo forest is communal bamboo forest. This type of forest is commonly owned and managed by groups of people in a village. The survey result reveals that 83.6 percent of the total respondents have communal bamboo forest while only few (16.4 percent) of the respondents have no access for communal forest. Of those farmers who own community bamboo forest, the majority (84.4 percent) of the farmers participate in collective bamboo forest management. The remaining (15.6 percent) of the local community members do not participate in any type of collective bamboo forest management activities. Moreover, few of them have no intention to participate in any collective action even in the future. Three main reasons for not participating in collective actions were mentioned

by KIIs and FGDs participants.

The first reason was lack of information regarding the cost and benefits of collective action in each study *woreda*. Some farmers lack economic and social incentives to participate in collective actions. The second reason is related to misperception on "deplorable" nature and state of bamboo forest. Despite dramatic decline in bamboo status, the local people in the study area customarily believe that bamboo would not be depleted by human action; hence it does not require any management as reported by the groups. The third reason was lack of commitment on the sides of the government in informing and coordinating the local people as reflected by KIIs. Interestingly, the FGD participants explain that farmers show interest to participate in any types of collective action if the local administrators effectively play coordinating role. This implies that the government institutions are not properly functioning in this regard as reflected by KIIs.

With the view of reducing bamboo deforestation, farmers in the study *woredas* have been participating in different collective forest management initiatives. The three common collective action initiatives are presented as follows: participation in conservation of natural resource management (soil erosion, afforestation/reforestation, watershed management, establishment of bamboo nursery sites), participation in hazard management (such as wildfire, flood control, pest control, weeds management), and participation in information provision. The three sets of collective action options that apply for bamboo forest management were discussed.

Table 1 presents that 34.1 percent of the respondents participate in multiple activities of collective actions. Multiple collective actions in this case imply participation in more than one type of collective activities at single point of time. Local farmers may participate in one or more of the following types of activities. They may participate in natural resource and hazard risk management, they may participate in natural resource management and information provision, and they may participate in hazard risk management and information provision. The result shows that only 9.1 percent of respondents participate solely in information provision. Of the total sample households, 15.6 percent do not participate in all the three types of collective action.

This finding indicates that there is lack of adequate information in the study area regarding NRM. As a result of such information asymmetry, illegal bamboo collectors, encroachers, loggers, informal bamboo exporters (who export to Sudan), and illegal charcoal trading activities substantially manifest in the study areas. Other collective action practices such as participation in NRM and participation in risk management accounted for 19.5 percent and 21.6 percent, respectively.

Table 2: Types of collective action practiced in the study area

Collective action choices	**Frequency**	**Percent**
No participation	60	15.6
Participation in afforstation/reforestation	75	19.5
Participation in hazard risk management	83	21.6
Participation in information provision	35	9.1
Participation in any of combined activities	131	34.1
Total	**384**	**100.0**

Source: survey data, 2014

3.1.1. The role of collective action for bamboo forest management

Collective action participant household farmers were asked whether any sort of changes had been observed as the result of their participation in collective action or otherwise. Accordingly, they mention some positive collective action outcomes (impacts) observed while they participate in community bamboo forest management. The participants reported five major changes observed due to participation in collective actions. About 30.1 percent of the participant respondents reported that participation in collective action has contributed in controlling and managing forest fire. Moreover, of the total respondents, 23.5 percent of household heads believe that the weather condition in their localities has improved due to their participation in community forest management. This result is in line with Yiping *et al.* (2010) finding that argues bamboo has high potential in capturing and sequestering atmospheric carbon and consequently reduces climate change. About 20.1 percent of the households believe that collective action in natural resource management activities, such as watershed management and soil and water conservation have positive consequences to enhance the production and productivities of agricultural output. Similarly, 13.7 percent of the respondents believe that collective bamboo forest management activities like bamboo seedling plantation maintain soil fertility and improve clean water availability in their localities. Some 12.7 percent of respondents reported that participation in collective action improve bamboo forest cover and overcome future scarcity.

Table 3: Multiple responses on the impacts of collective action for bamboo management

Impacts	Responses		
	Frequency	Percent	Percent of cases
Increased in soil quality	81	13.7	30.2
Increased in agricultural productivity	119	20.1	44.4
Decline in fire outbreak	178	30.1	66.4
Improved in weather condition	139	23.5	51.9
Increase in forest cover	75	12.7	28.0
Total	**592**	**100.0**	**220.9**

Source: Survey data, 2014

3.2. Regression Results

In the second model, there are at least three collective action initiatives. Individuals may engage in the three collective action initiatives by contributing their finances, labor or by allocating time to these activities or participate in all the three initiatives. Participation was measured by asking respondents whether they participate in any of the collective actions either through contribution of their time, labor or financial resources. Individuals who had participated at least in one of collective action initiatives by any of the aforementioned means are considered as participants.

3.2.1. Determinants of participation decision in collective action initiatives

In the preceding section, the dependent variable "general participation decision in collective action" was considered as dichotomous "participate or don't participate" in collective action initiatives, and the coefficients of the explanatory variables were estimated using binary probit model. However, in the subsequent section, the predictor variables explaining a set of outcomes "polycotomous" are estimated using multinomial probit model. In a simple statement, factors that determine the decision to participate in particular collective action initiatives are estimated using a MNP model.

Table 4: Empirical results of participation in collective action

Variable cod	Coefficients		
	NRM	Hazard Mgt	Information
SHIFT	-0.119	0.063	0.431
SEX	-0.402	0.574*	-0.770**
PRIGHT	0.063	-0.574*	-0.722*
ECOLOGY	-0.766*	0.045	0.299
SETTL	3.246*	-1.281	-2.324
CREDIT	-0.353	-0.407	-0.335
ADIVSE	-0.138	0.403	-0.360
TOTINCOM	0.252***	0.215**	0.074
SUPPORT	0.156	-0.295	-0.336
NTWORK	0.072**	0.104***	0.119***
TRUST	-0.181	0.0489	-0.048
HETROGN	-0.081	-0.098	-0.208
GROUP	0.600**	0.598**	0.255
_cons	-2.114	2.110	3.509
Number of obs	375		
Wald $\chi^2(56)$	110.69		
Log likelihood	-498.881		
Prob > χ^2	0.0000		

***, ** and * indicate the level of significance at 1 percent, 5 percent and 10 percent, respectively.

Source: Model out put

A large number of household respondents in the study practiced two or three types of collective actions. For example some farmers simultaneously participated in agro-forestry activities and hazard[1] management, agro-forestry management and information provision, hazard management and information provision, even they do participate in the three types of collective action. Determinants of such multiple participation strategies of collective action were not the discussion point of this study as it taken as the base category. Determinants of the three collective action initiatives are discussed as follows.

3.2.2. Determinants of participation in natural resource management

The MNP result reveals that participation in natural resource management is significantly influenced by factors,

[1] According to the definition given in Ethiopia national policy and strategy on disaster risk management, hazard is a potentially damaging physical event, phenomenon, and/or human activity that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation (FDRE, 2009).

such as agro-ecology, settlement condition, households' income, networking, and households' perceptions towards group size. In the following few paragraphs we described how those variables influenced participation in natural forest management.

Woyna-Dega agro-ecological locations of the households negatively and significantly influence participation in natural resource management at less than 10 percent significance level. This result was not as expected. It was hypothesized that households who live in *Woyna-Dega* agro-ecologies better participate in NRM as the rate of environmental challenges (deforestation and soil degradations) are more serious in *woyna-dega* agro-ecologies. And it was assumed that the problem could be more aggravated in *woyna-dega* due to high population density in the study area. This identifies that the farmers in *Woyna–Dega* agro-ecologies less likely participate in natural resource management system. The possible explanation for this anomaly could be the fact that local communities may be less motivated to cooperate and manage a highly deforested area or a fragile forest ecosystem of middle altitude areas, whose returns are highly uncertain. On the contrary, the farmers in *Kolla* agro-ecologies are more likely certain to participate in the NRM activities. The possible reason for better the participation of households in *kolla* agro-ecologies could be the impact of climate variability which might have motivated the households to actively participate in various climate adaption strategies, for instance tree planting and soil and water conservation activities.

The dummy variable "settlement condition" of the sample respondents was included in the model. The result shows that settlement condition of a household was positively and significantly influenced participation in natural forest conservation and protection (soil and water conservation activities, tree planting, afforestation and reforestation, water shed management activities, etc) at less than 10 percent significance level. This suggests that settlers who were brought by resettlement program from various regions of the country were more likely participating in NRM. On the contrary, the native people were found to be low participants on the natural conservation and protection activities.

As expected, total annual income of the household was found to have a very significant positive correlation with conservation in agro-forestry activities. This suggests that farmers who have better income may be more aware about the problem of the current environmental challenges, and hence actively participate in soil and water conservation activities. Moreover, households with better income may have better opportunity of employing the poor to participate in collective action on behalf of the rich. Furthermore, high income groups may be interested to participate in conservation of natural resource management, as they may better perceive long term benefits of natural resource management as compared to the low income groups. This result was supported by the findings of several empirical studies. For instance, Samuel (2004) found positive impact of household income for collective forest management in Zambia. Similarly, wondimagegnehu (2009) found positive effect of income in fostering collective action in Gambela region, Ethiopia. In contrast to this, Mesfin (2006) identified that an increase in annual income by one Ethiopian Birr (ETB), decreased the probability of farmer's decision of natural resource conservation in Gambela region, Ethiopia.

As alluded earlier, social capital enables people to act collectively and achieve the group interest. In this study, social networking had positively and significantly correlated with participation in natural resource management. The result reveals that households who had strong social capital with different social groups have better chance of participating in collective forestry activities. In this sense social capital has the power to enhance trust, reputation, and reciprocity among the group members. Farmers who belong to members' of social groups such as formal associations had a higher probability of participating in natural resource conservation. This result is supported by Neil (2003), who argued positive role of social capital in boosting collective action.

In contrast with the theory of group size, our econometric estimation shows that group size have positive and high significant effect for collective forest conservation activities. A large numbers of scholars (Meinzen-Dick *et al.,* 1997; Agrawal and Gibson, 1999; Frohlich and Oppenheimer, 1970; and Sandler, 1992) have argued for the positive impact of large group in forging collective action on forestry management.Other scholars indicate management inefficiencies in large groups because larger groups may fail to reach an agreement in realizing the group common interest. For example, Olson (1965) argued that unless the number of individuals in a group is quite small it would be difficult to handle self-interested individuals who will not strive to achieve their common or group interest. Chakraborty (2001) states that larger group sizes are obstacle to community cooperation, resulting in increased resource degradation.

3.2.3. Determinants of participation in hazard management

Natural disasters, such as fire outbreak, pest infestation, gregarious flowering of bamboo and epidemics of animal disease (trypanosomes) are the common challenges affecting local people in Benishangul Gumuz region. Moreover, challenges related to bamboo biodiversity protection problems, climate change and variability, unwise use of bio-energy, and soil and land degradation has been the other sides of environmental hazards. The effects of such natural disasters have also been resulting in cooperation among the resources user groups. Group participation in managing and protecting these hazards is an old age tradition of rural community in the study area, which is also considered as a risk management strategy. Empirical estimation was carried out to identify

factors that affect participation decision of the households in those hazard management activities. The MNP model result shows that sex of household head, forest property rights, and gross income earned by the households, heterogeneity and networking as important factors determining participation in hazard management strategies.

Participation in hazard risk management was influenced by the sex of the household head at less than 10 percent level of significance. The positive relationship between the probability of participating in disaster management and the sex of the household head suggests that male-headed households had better experiences of participating in hazarded management as compared to their counterpart female responders. For example, participation in clearing bush from farm plot is common practice adopted by local farmers to protect unexpected wildfire, which was mainly perceived as the responsibility of male-headed households. Female households hardly involve in these kinds of activities, one of the possible reason is cultural influence. Moreover, in controlling invasive species (*eg*.striga), termite management, and pest control like grasshopper manifestations, men's participation is significant.

The influences of property rights, total income earning, income heterogeneity and networking was found to be significant in affecting participation in hazard management. However, as these variables are briefly explained in the preceding sections, needless to discuss them under this section. Nevertheless, it should be noted that the effects of all the three variables on hazard management are strongly significant with positive sign. For instance, secure forest property rights by farmers have more incentive to participate in hazard management practices.

3.2.4. Determinants of participation in information provision

Provision of proper and reliable information to "forest task forces" regarding illegal[1] actors in their village has vital role in facilitating an informed decision by the concerned bodies. Understanding the advantages of information symmetry for effective natural resource management, this study examines factors affecting households' participation decision in information provision. The MNP model result shows that only three explanatory variables affect participation in information provision: Sex of the household head, property rights, and networking capacity.

Unexpectedly, the decision to participate in provision of information was negatively and significantly affected by the sex of the household heads. This shows that the probability of participating in information provision is lower for male-headed households than female-headed households. This could be reasoned out by the possible fact that female-headed households usually experience the burden of scarcity of bamboo and other forest resource, which could motivate them to expose illegal actors to the responsible bodies, such as local leaders and the task forces. Moreover, female-headed households may know charcoal traders and fuel-wood collectors than the male-headed housholds as these activities are closely related with female roles.

3.3. Marginal effects of explanatory variables in collective action initiatives

The marginal values of the multinomial probit model are presented in Table 9 below. The estimated probabilities of household participation in collective action of agro forestry, hazard management, information provision and combination of the two or three potions were 20.14 percent, 23.71, 9.13 percent, and 36.35 percent, respectively.

Table 5: Marginal effects of explanatory variables in MNP[2] model

Variables	Marginal effects				
	No-Participation	NRM	Hazard Mgt	Information	Mixed Strategy
SHIFT	-0.035	-0.093**	0.046	0.035	0.140**
SEX	0.061	0.118*	-0.077	-0.059	-0.042
Ecology	0.011	-0.207**	0.033	0.054	0.111
SETTL	0.061	0.470***	-0.306	-0.304*	-0.498
ADIVE	0.001	-0.039	0.135**	-0.054	-0.043
SUPPORT	0.035	0.104**	-0.030	-0.021	-0.088
NETWORK	-0.016***	-0.006	0.004	0.004*	0.013***
HETROGEN	0.059*	0.077	0.081*	0.020	-0.237***
Predicted value (No participation)			0.107		
Predicted value (Participation in NRM)			0 .201		
Predicted value (Participation in Risk Mgt)			0.237		
Predicted value (Participation in Info. Provision)			0.091		
Predicted value (Multiple participation)			0.364		

***, ** and * indicate the level of significance at 1 percent, 5 percent and 10 percent, respectively.

Source: Model output

[1] Illegal actors meant households who engage illegally, and perhaps irrationally harvesting underage bamboo (young bamboo), wet and unripe bamboo collectors, who participate in illegal export, encroachers, and also involve in charcoal preparation.

[2] One assumption of MNP model is that it takes the outcome with highest frequency as the base category. Since mixed participation has hest frequency then it was taken as a base category during the MNP model estimation.

In the following few paragraphs the marginal values of highly significant variables are discussed in considerable detail.

This research considers a continuous explanatory variable "amount of shifting cultivation", measured in (hectares) to capture differences in collective action choices among households. The coefficient for participation in natural resource management (NRM) is negative and significant at 5 percent significance, whilst it is positive and significant under mixed or multiple strategies. In addition, the coefficient is negative and positive for hazard/risk management and information provision respectively, yet insignificant in influencing both strategies. The result implies that an increase the amount of shifting cultivation decreases the propensity of participating in natural resource conservation activities by 9.3 percent, while it increases the combined participation strategy by 14 percent.

Various studies have shown that sex is an important variable affecting participation in collective action. The result depicted that sex has significant and positive influence with participation in natural resource management. In the other three participation strategies the effect of sex was found to be negative, but statistically insignificant. The implication is that keeping all other factors constant, being male-headed households increase the likelihood of participation in natural resource management by 11.8 percent.

The coefficient for the dummy variable agro-ecology was found to be negative and significant for forest resource management option, while it is positive but insignificant under the other three scenarios. The explanation for the effects of marginal change in agro-ecology on participation of NRM is similar with the pervious discussion. This means that being a household located from *woynadega* agro-ecology reduces the probability of participation in NRM by about 20.7 percent. The rational for these could be those households in *woynadega* agro-ecologies may focus on other livelihood activities than conservation measures.

The effect of the settlement conditions of households on collective action choice was assessed. The result shows that settlement has positive and statistically significant influence on households' participation decision in co-management of NRM activities (afforestation, reforestation, soil and water conservation and plantation forests). On the other hand, settlement condition had negative and significant effect on information provision. Being settlers increased the probability of participation in natural resource management choice by 47 percent and decreased the probability of participating information provision by 30.4 percent. This implies that immigrant setters feel better responsibility in conserving natural resource base than the native ethnic groups. These could be due to environmental challenge they might have experienced in their previous locations. However, settlers seem shay in reporting and exposing illegal actors in their surroundings.

Accesses to extension services seem to have a strong positive influence on the probability of participating in risk management. However, in all other potions access to extension service have negative influence but statistically insignificant. The result implies that access to extension advice by the household farmers bring about 13.5 percent increase in probability of participating in hazard management. Positive correlation between extension contact and participation in hazard management may be due to policy direction of the regional government regarding environmental hazard managements.

External support received by the household farmers from government agents and non- governmental organizations had positively affected participation in NRM and the effect was found to be positive. Households who receive various supports (technical, material, policy, training, and moral) have increased participation in natural resource conservation issues by 14.7 percent. This finding is consistent with our hypothesis. Contrary to our expectations, some empirical studies in northern parts of Ethiopia came up with the reverse outcome (Berhanu et *al.,* 2000). According to Pender and Scherr (1999), in Honduras, external government organizations were found to displace local collective action. One important thing that shall be considered is that the effect of external support on the other two participation types was negative, but insignificant.

With regard to networking, the study identifies that social networking have positive and significant association with information provision. An increase in the number of networking increases the probability of participating in information provision by 0.4 percent. These findings are consistent with other argument that states "the norms and networks that enable people to act collectively" in natural resource management by providing people adequate information through their network (Woolcock and Narayan 2000; Neil, 2003). Social networks are thought to be a precondition to collective action in forest management (Feiock, 2007; Cigler, 1994), supporting our finding.

Finally, the impact of income heterogeneity on collective action was assessed. This finding suggests that economic heterogeneity positively and significantly influenced participation in hazard management. The result implies that income heterogeneity among the bamboo users increase the probability of participation in hazard management by 8.1 percent. This finding is in agreement with theoretical examinations, which suggest that economic heterogeneity increases the likelihood of collective action. For example, Olson (1965) in his theoretical explanations provided positive impact of heterogeneity on the likelihood of collective action. In the Indian Himalayas, Somanathan *et al.* (2007) found that land equality has a significant positive association with collective action. Baker (2000) on his part demonstrated a negative U-shaped relationship between heterogeneity

and collective action India, while Adhikari and Lovett (2006) identified negative relationships between income heterogeneity and collective action.

CONCLUSION

The purpose of this paper is to identity factors that influence participation collective action bamboo forest management. The result shows that three types of bamboo forest exist in the study area: community bamboo forest, privately owned bamboo forest, and protected bamboo forest. Of the respondents who own community bamboo forest about 84.4 percent of household farmers participate in collective action. Despite high level of participation in collective action, bamboo deforestation in BGR was found to be the central development challenge. To curb the problem, local farmers in the study area participate in various collective action initiatives. Basally the local farmers participate in three collective action activities: they participate in NRM, hazard risk management, and information provisions. Because of participation in collective actions, a range of economic, social and environmental positive impacts were realized. For instance, due to collective bamboo forest management farmers' agricultural productions have improved. Collective bamboo forest management activities, particularly bamboo seedling plantation maintained soil fertility and improved clean water availability in their localities. This study identified qualitative factors that positively influence participation in collective action: settlement condition of the respondents, perceived bamboo benefit, tenure security, access for credit service, training/advise on NRM, perception on establishment of bamboo factory, access for external support, household with secure forest property right, and household dependence on bamboo collection were presented.

This study has also identified factors that affect the various types of collective actions. The study found that that participation in natural resource management is significantly influenced by ecology, settlement condition, income, networking, and perception for large group size. The MNP model result also shows that sex of household head, forest property rights, and total income earned by the households, heterogeneity and networking as important factors determining participation in hazard management strategies. In addition, the MNP model result demonstrates that sex of the household head, property right, and household head networking capacity has effect on group participation in information provision.

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REFERENCE

Agrawal, A. and C. C. Gibson. 1999. Enchantment and disenchantment: The role of community in natural resource conservation. World Development. 27(4): 629-49.

Bekele Hundie. 2008. Pastoralisim, Institution and Social Interaction. Explaining the co existence of Conflict and Cooperation in pastoral Afar, Ethiopia.

Ben-Akiva, M. and Bolduc, D. 1996. Multinomial probit with a logit kernel and a general parametric specification of the covariance structure. Paper presented at the 3rd Invitational Choice Symposium, Columbia University.

Berhanu, G., J. Pender, and Girmay, T. 2000. Community Natural Resource Management: The Case of Woodlots in Northern Ethiopia. *International Food Policy Research Institute Washington*, D.C. 20006 U.S.A. EPTD Discussion Paper No. 60.

Berhanu, G., J. Pender, and Girmay, T. 2000. Community Natural Resource Management: The Case of Woodlots in Northern Ethiopia. International Food Policy Research Institute Washington, D.C. 20006 U.S.A. EPTD Discussion Paper No. 60.

Bwalya, S. M. 2004. Rural Livelihoods and Collective Action in Joint Forest Management in Zambia. Dept of environmental and Natural resource economics Greenhouse road, Kingston, USA.Cambridge University Press.

Chakraborty, R. N. 2001. Stability and outcomes of common property institutions in forestry: evidence from the Terai region of Nepal. Ecological Economics, 36(2), 341-353.

Crawford, Sue, and Elinor Ostrom. 2005. "A Grammar of Institutions" In Understanding Institutional Diversity, ed. Elinor Ostrom, 137-174. Princeton, NJ: Princeton University Press.

Dercon, S. J., Hoddinott, Krishnan P. and Tassew W. 2008. Collective Action and Vulnerability Burial Societies in Rural Ethiopia. CAPRi Working Paper No. 83.

FEIOCK. R. C. 2007. Rational Choice and Regional Governance. Journal of Urban Affairs, Volume 29, Number 1, pages 47–63. Florida State University

Fekadu Beyene. 2008. Challenges and Options in Governing Common Property. Customary Institutions among

(Agro-) Pastoralists in Ethiopia.
Frohlich, Norman and Joe A. Oppenheimer .1970. "I Get By with a Little Help from My Friends," World Politics, XXIII (October): 104-121.
Greene, W. H., 2012. Econometric Analysis. Seventh Edition, New Jersey: Pearson Hall, USA.
Hausman, J. and D. McFadden, 1984. Specification of the multinomial logit model. Econometrica, 52(5):1219-1240.
Knox, A. and Meinzen-Dick, R. 2001. Collective Action and Property Rights and Devolution of Natural Resource Management. Exchange of Knowledge and implication for Policy. *CAPRI working Paper*. No.11.
Krishaswami O.R. 1992. Theory of Cooperation: An In depth Analysis. Coimbatore: Shanma Publications.
Long. J. S. 1997. Regression Models for Categorical and Limited Dependent Variables. Advanced Quantitative Techniques in the Social Sciences Number 7. Sage Publications: Thousand Oaks, CA.
Maddala. G.S. 1983. Limited Dependent and Qualitative Variables in Econometrics, Cambridge University Press.
McCarthy, C. and Dutilly-Diane, B. 2002. Cooperation, Collective Action and Natural Resources Management in Burkina Faso: Methodological Note. Drabo.Capri Working Paper No. 27.
Meinzen-Dick, R. and Di Gregorio, M. 2004. Collective Action and Property Rights for Sustainable Development.
Meinzen-Dick. 1997 "Gender, property rights, and natural resources", World Development, Vol. 25, No. 8, (1299-1302).
Mesfin Duguma. 2006. Farmers' Perception on Soil Erosion and Decision on Land Management in Assosa Woreda, Ethiopia. MA. Thesis submitted to Haramaya University.
Mwangi. M.2005. The Transformation of Property Rights in Kenya's Maasailand: Triggers and Motivations.
Ngaido, T. and Kirk, M. 2000. Collective Action, Property Rights, and Devolution of Rangeland Management: Selected examples from Africa and Asia. ICARDA Social Science Paper No.10 ICARDA, Aleppo, Syria.
Olson, M., 1965. The logic of Collective Action. Public goods and the theory of Groups. Harvard University Pres. London, England.
Ostrom, Elinor. 2007. "Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework" In Theories of the Policy Process, ed. Paul A. Sabatier, 21-64. Boulder, CO: Westview Press.
Pender, J., Scherr, S., and Duron, G. 1999. Pathways of development in the hillsides of Honduras: Causes and implications for agricultural production, poverty and sustainable resource use. EPTD Discussion Paper No. 45. Washington, DC, USA: International Food Policy Research Institute.
Poteete, A. and Ostrom, E. 2004. Heterogeneity, Group Size and Collective Action: The Role of Institutions in Forest Management. (29): 435–461.
Somanathan, E., R. Prabhakar, and B.S. Mehta .2007. "Collective action for forest conservation: does heterogeneity matter?" In Inequality, Cooperation, and Environmental Sustainability, edited by J-M Baland, J-P Platteau, and S. Bowles, Princeton University Press, Princeton, New Jersey, pp. 234-245.
Woolcock, Michael & Deepa Narayan, 2000. Social Capital: Implications for Development Theory, Research, and Policy, World Bank Research Observer, 15(2): 225-249.
Wooldridge, J.M. 2008. "Nonlinear Dynamic Panel Data Models with Unobserved 41 Effects," invited lecture, Canadian Econometrics Study Group, Montreal, September 2008.
Yemiru Tesfaye. 2011. Participatory Forest Management for Sustainable Livelihoods in the Bale Mountains, Southern Ethiopia. (Published doctoral thesis) Swedish University of Agricultural Sciences, Uppsala.
Yiping L, Yanxia L, Buckingham K, Henley G, Buomo Z. 2010. Bamboo and climate change mitigation. Technical report. International Network for Bamboo and Rattan