Analysis of participation in collective action initiatives for addressing unilateral agri-environmental externalities

Daniel Kyalo Willy, Arnim Kuhn, Karin Holm Müller

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Daniel Kyalo Willy[1,2], Arnim Kuhn[1], Karin Holm Müller[1]

1. Institute for Food and Resource Economics, University of Bonn; 2. Kenyatta University, School of Agriculture and Enterprise Development

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Abstract

The fact that agriculture is associated with negative external effects on ecosystems is of great concern. Most of these agri-environmental externalities are public goods in nature and therefore solving them through conventional market and regulation tools is challenging. Collective action has been identified as an option in dealing with externalities emanating from activities touching on agriculture and the environment especially in circumstances where markets and government regulation are not effective. In this paper we assess the potential for agri-environmental cooperation in dealing with agri-environmental externalities. The study achieves this objective using cross-sectional household survey data collected from 308 households in the Lake Naivasha basin, Kenya. Results indicate that non-cooperation is a dominant strategy in the Lake Naivasha basin. The study also identifies factors that influence the probability of cooperating and therefore could be catalysts to encourage cooperation. Such factors include expected private incentives, labour endowments and agricultural commercialization. Positive perceptions and attitudes, presence of social sanctions and norms of trust were also found to significantly influence cooperation. To deal with agri-environmental challenges through cooperation, policy needs to focus on facilitating selective incentives, awareness creation and embracing local participation in resource management.

Key words: Cooperation; Incentives; Institutions; Lake Basin; Community Initiatives; Soil Erosion

1. Introduction

The problem of agri-environmental externalities has been a challenge to policy makers for a long time in both low and high income countries. The externalities emanate from the fact that agriculture draws most of the major inputs and natural services from nature, therefore creating direct interdependence between agriculture and the environment (Power 2010). Because of this interdependence, agriculture is usually associated with processes that impact the environment negatively such as deforestation, land degradation, greenhouse gas emissions, soil erosion, water pollution and biodiversity loss. In seeking effective mechanisms for resolving environmental problems emanating from agriculture, researchers have in the recent past increasingly assessed the potential for using cooperative/suasive instruments to deal with agri-environmental externalities. Some of the most studied cooperative initiatives touching on agriculture and the environment include agri-environmental cooperatives, watershed management programmes, ground water management programmes, communal irrigation schemes and voluntary land diversion schemes (Ostrom 1990; White and Runge 1994; Goldman et al. 2007; Cárdenas et al. 2009).

Most of the case studies mentioned here have identified agri-environmental cooperation initiatives as one of the possible instruments to successfully mediate interactions between agriculture and the environment. It has been found that agri-environmental cooperation can help to achieve near Pareto optimal solutions especially where markets and government regulatory instruments have limited success (Lubell et al. 2002). The limited success in command and control and market based instruments can be attributed to a number of reasons. The attributes of agri-environmental externalities such as non-point agricultural pollution (e.g. heterogeneity of polluters, large spatial extent and difficulty in monitoring individual polluters) make it difficult for command and control instruments to effectively achieve the environmental goals. On the other hand, difficulties in developing effective property rights make it challenging to solve agri-environmental pollution through the markets. Therefore collective action can be used as a local mechanism through which solutions to agri-environmental externalities can be found under conditions with insufficient formal institutions, as is often the case in poor countries.

In general terms, collective action involves voluntary contribution by individuals into collective efforts towards achieving a common goal(Poteete and Ostrom 2004; Meinzen-Dick and Di Gregorio 2004). In most cases such a common goal would involve the production of a

collective good or service. Specifically, agri-environmental cooperation is defined as a voluntary collective action initiative that involves a continuum of commitment ranging from awareness creation and information sharing to collaboration of heterogeneous individuals who have shared goals and anticipate benefits from their cooperative efforts (Polman and Slagen 2002). In the current study, collective action and cooperation have similar connotation and therefore these two terms will be used synonymously. Agri-environmental cooperation entails horizontal non-market coordination mechanisms where individuals voluntarily and collectively engage in action selection and implementation, information gathering and sharing, organizational adjustments and conflict resolution (Hagedorn et al. 2002). Action selection in agricultural externalities' context involves collective choice of activities and technologies which involve both generation of environmental goods and services and mitigation of negative externalities produced jointly with agricultural commodities.

Esteban & Dinar (2013) demonstrate that cooperation in the management of groundwater where externalities are present can yield a Pareto improvement. The study finds that farmers were better off with cooperation than without. Ayer (1997) presents some successful cases of grass root collective action initiatives that were initiated to deal with externalities caused by pesticide application and washing of manure, inorganic fertilizers and eroded soils into water courses in the USA. The author identifies grass root collective action as one of the options for addressing agri-environmental problems that have the potential of moving production closer to a Pareto optimum than would the uncoordinated self-interest decisions of individuals and firms in the absence of a formal regulatory framework. White & Runge (1994) also present a case of successful cooperation in managing a watershed in Haiti, within a society that had historically been branded incapable of self organization.

From these case studies we identify some fundamental aspects. First, since agri-environmental externalities create collective action dilemmas, they might best be addressed using collective solutions (Ostrom 1990; Ayer 1997). Second, due to the large number of individual farmers involved, generation of ecosystem services will succeed if coordinated at landscape scale. Third, coordination mechanisms would succeed if designed to encourage the participation of as many land owners as possible. What we note however, is that empirical studies in the area of agri-environmental externalities in low-income countries are rare. Except a few cases (e.g. White & Runge 1994), most of the existing empirical studies on agri-environmental schemes are

from high income countries. At the same time, agriculture continues to be a dominant sector in most low-income countries and therefore agricultural sustainability is no longer an optional but a priority focal area. Therefore studies in the area of agri-environmental interactions may play a key role in informing policy to guide sustainability in agriculture.

The current study seeks to contribute to the understanding of how collective action around agri-environmental externalities can work in a low income country setting. Using empirical household survey data from a watershed located in rural Kenya, the current study sets out to assess the potential for agri-environmental cooperation in addressing externalities. Here we consider positive and negative benefits that emerge from collective water management, soil erosion control at community level, reforestation and other similar activities that generate local public goods including ecosystem services goods. The broad goal of the study is achieved in two steps. First, a two-step cluster analysis approach is used to identify the cooperative behavior of sample households in the Lake Naivasha basin by assessing their degree of participation in activities involving voluntary provision of public goods in the community. Through this, households are categorized either as cooperators or non co-operators. Second, the study utilizes a logistic regression model to identify factors that make individuals more likely to cooperate.

2. Description of the Lake Naivasha Basin

The Lake basin is located in the Kenyan Rift Valley at 0º30’ S-$0^0$55' and 36^0 09' E- $36^0$24' E. The basin supports a vibrant commercial horticulture and floriculture industry, whose growth has accelerated greatly in the past two decades due to good climatic conditions and existing links to local and international markets for vegetables and cut flowers. The industry promotes economic growth and livelihood support in the basin by offering employment and income opportunities and engagement of small holder farmers in out-grower schemes. Further, the basin supports tourism, fisheries, and pastoral and small holder subsistence food production. Irrigated floriculture occupies about 5025 ha around the Lake (Reta 2011) while small scale farms occupy approximately 210,000 ha, with an average 2.5 acres per farm household.

In the upper catchment of the basin, there are a number of activities which need communal participation because they entail provision of public goods. First, agricultural activities and especially expansion of crop land into fragile areas such as steep slopes and riparian land and deforestation have been identified as a major cause of increased soil erosion

which have been linked to deterioration of water quality problems and biodiversity loss (Becht 2007; Kitaka et al. 2002; Stoof-Leichsenring et al. 2011;Willy et al. 2012). Secondly, gullies on public land, road sides, foot paths and livestock trails are also hot spots for non point water pollution. Third, most areas in the upper catchment have water projects which supply water for domestic use and irrigation to its members. These water projects are managed communally and monitoring of compliance to rules is done by members. Fourth, most rural access roads are usually impassable during the rainy seasons. To solve the collective challenge, community members are usually called upon to participate in maintenance of the roads. Solving all the problems highlighted above entails provision of public goods and therefore it might be challenging to attain optimal participation. Since community members are required to participate voluntarily, it is expected that they must consider the costs of participating in such activities against the benefits they are likely to get.

3. Theoretical Framework and Methodology

The Theory of Collective Action: Why Do People Co-operate?

In the book '*The Logic of Collective Action',* Mancur Olson (1965) offers a clear explanation on group and organizational behavior, showing when it will be at the best interest of individuals to contribute individual efforts towards the provision of a collective good. Olson considers individuals engaged in the production of a collective good. In his model, the utility that each individual generates from the collective good is assumed to depend on the total amount of the good produced. Further, the total amount of the collective good produced depends on the contribution from each individual. Olson identifies three conditions under which rational individuals will cooperate: (1) if there are substantial coercion, (2) if free riding is easily noticeable within the group and (3) when there are selective incentives. Coercion could either come from social pressure or a legal requirement. The ability to notice free riding depends on the extent to which each person's actions are visible and are likely to affect the utility of others. If the group is too large to the extent that free riding can go un-noticed then collective action is unlikely to occur. Visibility depends on (but is not limited to) the size of the group. Selective benefits on the other hand relate to the question of whether the group offers additional incentives to its members that would not be available to non-members. According to Olson, there will be no

substantial participation in collective action unless members are enticed with such selective benefits (p51).

However, Oliver (1984) indicates that sometimes people will be willing to cooperate even if no one else is willing to cooperate similar to what Olson (1965) calls 'privilege' in a group. This can happen if either there are some altruistic individuals in the society who will be willing to take the burden of providing a public good even when no one else is willing to do so or when some individuals value the collective good more than others. Studying cooperation in interest groups, King &Walker (1992) find that people are more likely to cooperate if they are mobilizing against a collective bad that would threaten a common good. If individuals are convinced that a collective bad (or an externality) is a common threat, they will be willing to self organize towards solving the problem and protect group interests. The study draws a sharp contradiction to the selective incentives condition by Olson (1965). Rather, King & Walker (1992) conclude that under certain circumstances, the collective action dilemma can be overcome without necessarily having the groups provide pure private goods to individual members.

Another framework developed by Hagedorn et al. (2002) introduces the premise that the attributes of individuals and the transactions emanating from their activities are important in situations involving agri-environmental cooperation. The objectives of actors, their resource endowments, value systems, beliefs, attitudes and perceptions play a major role in determining their willingness and ability to cooperate with others and comply with collectively established rules (Hagedorn et al. 2002). Physical, social and human resources facilitate cooperation since they enable individuals to access information, power and social networks which help them to safeguard their interests, whether collective or individual.

Data

The current study utilizes primary data that were collected through a household survey conducted among 307[1] households in the Lake Naivasha basin in April-July, 2011. A multistage stratified random sampling procedure was used to select households included in the sample. In the first stage, we purposively selected 8 Water Resource Users Associations (WRUAs) to form

[1] However, seven cases were regarded as outliers in the cluster analysis and therefore were dropped from the logistic regression analysis.

our sampling strata. For each stratum a sampling frame was generated with the help of WRUA officials and village elders. A random sample of households was then drawn from each WRUA, proportional to size. A semi-structured interview schedule was then administered through personal interviews with household heads and/or their spouses as respondents. During the survey, respondents were asked questions with regard to their previous participation in activities organized at community level and requiring participation from community members. Data was also captured on their individual attributes such as socio-economic attributes, capital endowments (physical, natural, social and human capital), perceptions and attitudes. The household data was complemented by information gathered during focus group discussions involving key informants drawn from each WRUA.

Analytical Framework

The current study utilizes two step cluster analysis (Chiu et al., 2001) and logistic regression approaches. Cluster analysis was used to assess the tendencies to cooperate or fail to co-operate among sampled farmers in the Lake Naivasha basin. The first step in this process was to select ideal variables that would be used in clustering. Since our objective was to cluster households based on their co-cooperativeness, we used variables which captured previous participation of households in activities involving voluntary contribution to collective efforts within the village such as: communal tree planting, management of communal irrigation systems, maintenance of communal access roads and collective soil conservation. Using the cluster analysis procedure, the sampled households were clustered into cooperators and non-co-operators. Validation of Cluster analysis results was done by splitting the data into two and carrying out cluster analysis on each data segment to see if the results were similar. To control for the possible ordering bias, the data were sorted by the last digit in ascending order. The outcome of this procedure was a dependent variable to be used in logistic regression in the next stage in the analysis.

Logistic regression model was used to assess the determinants of cooperation in collective action. The general form of the logit model can is:

$$P[y_i = 1|x_i] = G(x_i, \beta) \quad (1)$$

where $G(\cdot)$ is the standard logistic distribution function which takes values between 0 and 1 (Verbeek 2012). Equation (1) can be re-written in terms of odds ratios as shown in equation (2):

$$log\frac{p_i}{1-p_i} = x_i^{'}\beta \quad or \quad \frac{p_i}{1-p_i} = exp(x_i^{'}\beta) \tag{2}$$

where p_i is the probability of observing the outcome $y_i = 1$ (cooperation and $p_i/1-p_i$ is the odds ratio which is equivalent to exponentiated coefficients. The odds ratio can be interpreted as the number of times by which the odds of the outcome $y_i = 1$ will be higher than the odds of the outcome $y_i = 0$ (non co-operation) if the j^{th} predictor increases by one unit. However, to see the effect of an explanatory variable on the probability of being a co-operator (p_i), the marginal effects are estimated.

The empirical formulation of the model used in the analysis was:

$$\begin{aligned} COOP_i = {} & \beta_1 SLOPE + \beta_2 COPBEN + \beta_3 HHEDUC + \beta_4 HHSIZE + \beta_5 LANDTEN \\ & + \beta_6 PEERMON + \beta_7 OFFARM + \beta_8 CRITZ + \beta_9 HHLOC + \beta_{10} IRR \\ & + \beta_{11} SCARC + \beta_{12} AWARE + \beta_{13} EXTN + \beta_{14} TAMK + \beta_{15} BHOLE + \beta_{16} EXCH \\ & + \beta_{17} COMME + \beta_{18} ASSET + \beta_{19} TRUST + \varepsilon_i \end{aligned}$$

COOP was the dependent variable taking the value of 1 if individual *i* was a co-operator and 0 if a non co-operator. The explanatory variables are as described in Table 1. Equation (1.6) was estimated using STATA 12 and average marginal effects obtained using the *margins* post estimation command.

Table 1: Factors hypothesized to influence cooperation

Variable name	Description of Variables	Measure	Expected sign
LANDTEN	Holds land title deed	Dummy (1=Yes)	+
IRR	Practicing irrigation	Dummy (1=Yes)	+
SLOPE	Farm located in extremely sloping area	Dummy (1=Yes)	+
HHEDUC	Household education	Years	+
EXTN	Perceives externality exists	Dummy (1=Yes)	+
OFFARM	Engagement in off farm activity	Dummy (1=Yes)	-
ASSET	Value of assets owned	Index (0-1)	-
COPBEN	Perception that cooperation is beneficial	Dummy (1=Yes)	+
HHSIZE	Household size	Number	+
TAMK	Distance to nearest tarmak road	Kms	+
AWARE	Awareness of government water rules	Dummy (1=Yes)	+
CRITZ	Believe that non co-operators will be criticized	Dummy (1=Yes)	+
TRUST	Trusts other community members	Dummy (1=Yes)	+
EXCH	Exchanged farm inputs previously	Dummy (1=Yes)	+
PEERMON	Existence of community peer monitoring	Dummy (1=Yes)	+
SCARC	Perception that water scarcity is a problem	Dummy (1=Yes)	+
HHLOC	Location of the household	Dummy (1=Extreme Upstream)	-
BHOLE	Owns borehole/well	Dummy (1=Yes)	-
COMME	Proportion of marketed output	Number (0-1)	+

4. Results and Discussions

Using cluster analysis, each household was categorized either as a cooperator or a non co-operator. Cluster analysis results indicate that there were 181 (60.3%) non co-operators category and 119 (39.7%) cooperators. Table 3 presents percentages of households in each of the category based on the variables used to the generate clusters. Note that the percentages in the table should be compared horizontally. Chi-square (χ^2) statistic was used to test the null hypotheses that the percentages of individuals in the two categories are not statistically different.

For most of the variables, the null hypotheses were strongly rejected and therefore there are significant differences in the percentage of individuals falling under the two categories.

On average the cooperators spend 37.1 (SD=60.83) hours on communal activities within 2010. Cooperators made an average financial contribution of Kshs. 1,152 ranging from zero contribution to Kshs. 11,000. As shown in Table 2 group membership and membership in Water Resource User Associations (WRUAs) was dominated by cooperators and while membership in community water projects (CWPs) was dominated by non co-operators. About 55% of all those who indicated membership in WRUAs were cooperators while 51.4% of CWPs members were non cooperators. Despite this dominance in CWP membership, non-co-operators did not participate in any of the activities that required voluntary contribution; neither did they contribute finances towards collective initiatives. A large percentage of the households in the non-co-operators category showed incidences of free riding. For example none of the non co-operators had participated in a water related communal activity that is required for all CWP members. Also, only 62% of the non co-operators had made financial contributions towards communal water management activities. The majority of those who had exchanged planting materials with other farmers were non co-operators. Exchange of planting materials is based on the expectation that individual efforts will be reciprocated by their exchange partners. Non co-operators also had majority of the group memberships (58.2% against 41.8% of cooperators). Membership in groups such as rotating savings and credit associations (commonly called Merry-Go-Round) are also based on reciprocate assurance since they are formed by people with close social ties and friendships and therefore once a member contributes their finances or time, they are assured that they will recover their contribution later or benefit in another way.

Table 3: Attributes of cooperators and Non co-operators

		Non co-operators **N=181**	**Cooperators N=119**	χ^2 statistic
WRUA membership	No	75.3%	24.7%	29.72***
	Yes	44.5%	55.5%	
Financial contribution towards water management	No	72.9%	27.1%	27.17***
	Yes	46.9%	53.1%	
Time commitment towards communal activities	None	100%	0.0%	300.01***
	Moderate	0.0%	100.0%	
	High	0.0%	100.0%	
Exchanged planting materials with other farmers	No	71.4%	28.6%	2.03
	Yes	58.9%	41.1%	
At least one household member has membership in a group	No	65.5%	34.5%	191.03
	Yes	58.2%	41.8%	
Membership in community water project	No	81.1%	18.9%	23.19***
	Yes	51.4%	48.6%	
Participation in water related communal activity	No	84.6%	15.4%	183.37***
	Yes	0.0%	100.0%	
Involvement in communal tree planting exercise	No	66.5%	33.5%	46.972***
	Yes	0.0%	100.0%	
Involvement in communal soil conservation exercise	No	61.6%	38.4%	9.312***
	Yes	0.0%	100.0%	
Involvement in construction of communal facility	No	61.6%	38.4%	9.312***
	Yes	0.0%	100.0%	
Involvement in maintenance of communal access roads	No	62.2%	37.8%	14.112***
	Yes	0.0%	100.0%	

*** indicates significance at the 0.01 level.

Table 3 presents the odds ratios and average marginal effects obtained using logistic regression model. Considering the model summary statistics and their significance levels given at the bottom of Table 3, we can reject the null hypothesis that all the regression coefficients are simultaneously equal to zero. The McFadden's pseudo R^2 is 0.20 which is satisfactory.

Table 3: Coefficients and Marginal effects of determinants of cooperation tendencies

Explanatory variable	Odds Ratio	Std. Err.	Average marginal effects	Std. Err.
Holds land title deed	1.12	0.347	0.02	0.056
Practicing irrigation	1.97**	0.690	0.12	0.062
Farm located in extremely sloping area	2.87**	1.415	0.19	0.086
Household education	1.17***	0.063	0.03	0.009
Perceives externality exists	1.34	0.432	0.05	0.058
Engagement in off farm activity	1.03	0.426	0.01	0.074
Value of assets owned	0.21	0.279	-0.28	0.240
Perception that cooperation is beneficial	2.44***	0.825	0.16	0.058
Household size	1.21***	0.083	0.03	0.012
Distance to nearest tarmak road	1.00	0.038	0.00	0.007
Awarenes of government water rules	1.37	0.421	0.06	0.055
Believe that non co-operators will be criticized	2.52***	0.953	0.17	0.066
Trusts other community members	2.46**	0.973	0.16	0.069
Enganged in exchange of inputs	1.19	0.550	0.03	0.083
Existence of community peer monitoring	1.49	0.471	0.07	0.056
Perception that water scarcity is a problem	1.50	0.448	0.07	0.053
Location of the household	2.29***	0.774	0.15	0.058
Owns borehole/well	0.84	0.341	-0.03	0.073
Proportion of marketed output	0.38***	0.207	-0.17	0.096

Model summary statistics

Number of obs	299
LR chi2(19)	82.84***
Log likelihood	-159.56
Pseudo R2	0.21

*,**,*** indicates significance at the 0.1, 0.05 and 0.01 levels respectively

The average marginal effects are the values by which the probability of an individual being a cooperator increases or decrease when a continuous explanatory variable increases by one unit. For a dummy explanatory variable, the average marginal effect represents the effect of a discrete change of an explanatory variable from 0 to 1. On the other hand, the odds ratios represent the multiplicative factor of the odds of being a non co-operator relative to that of being a cooperator when an explanatory variable increases by one unit. For example, an odds ratio of 1.2 associated with the household size variable implies that with an increase of household size by one person, the odd ratio of being a cooperator will be 1.2 times higher than that of being a non co-operator. That implies that an increase in household size makes someone more likely to be a cooperator. The average marginal effects were also estimated. Positive marginal effects are those that encourage cooperation while the negative ones are those that discourage cooperation.

Eight covariates had a positive significant influence on the probability of being a cooperator while one had a negative significant influence. These factors can be placed in four distinct categories: *household endowments, expected benefits, trust, attitudes and perceptions*.

In the first category, household size and average household education level had positive significant effects on the probability of being a cooperator. Household size represents labour availability and therefore households who have more labour resources have less labour constraints and therefore can allocate part of their labour to cooperative initiatives. The average household level of education is a measure of human capital. Human capital enhances cooperation due to the skills that individuals acquire through education which enable them to engage with other parties in the community. However, the fact that households who lack substantial skills tend to fail to co-operate has the intuitive implication that cooperation may fuel marginalization and benefits associated with cooperation may accrue to those who are already better off as also observed by Lubell et al. (2002). Our results reject the null hypothesis that the general level of trust that an individual has in other community members does not enhance cooperation. Trust makes cooperation easier since it reduces transaction costs that people may incur when searching for credible cooperation partners that are expected to need less monitoring and enforcement. Our results are in agreement with those of previous studies such as those of Baland & Platteau (1996).

In the expected benefits category, three variables had a positive significant effect on the probability of being a cooperator. Households who were practicing irrigation were more likely to cooperate. Water for irrigation can be seen as a selective benefit that only water project members

can access, therefore an individual is likely to benefit privately through cooperating with others. Therefore there is an incentive for irrigators to participate in collective action so as to maintain a flow of these benefits. Farmers who have alternative access to water for example through ownership of a private borehole or well were found to be less likely to cooperate. However, the effect of this factor was insignificant. The slope of the farm had a positive significant effect on cooperation confirming our hypothesis. Extreme slope makes cooperation attractive since the expected benefits from cooperation are higher. It could also be that in such areas, the problem of extreme soil erosion is more visible and therefore farmers in these areas will be willing to cooperate to solve the common problem. Our results strongly reject the hypothesis that farmers located upstream are likely to fail to co-operate. A possible explanation to this finding is that since most cooperation generates other selective benefits, this is a win-win for the farmers located in extreme upstream and therefore an incentive for them to cooperate. Being located in the extreme upstream WRUAs also implies that the households are closer to the sources of rivers from where most community water projects have their points of common water intake. Therefore, by virtue of it being technically easier to tap water and distribute among its members without additional pumping costs makes it attractive to cooperate and establish a common water distribution system. Cooperation may further be boosted by the fact that most of extremely upstream households are also located in extremely sloped areas.

Two variables representing attitudes and perceptions were found to significantly influence cooperation. For obvious reasons, individuals who perceived that participating in communal activities is beneficial were also more likely to cooperate. The second factor was the belief that those who fail to co-operate are likely to face social ridicule. Those who responded to the positive were found to be also more likely to cooperate. This result can be used to infer that informal constraints and internal sanctions such as fear of social exclusion and public ridicule are effective tools that facilitate cooperation in a society. These instruments work through guilt and fear of loss of self respect. However, their effectiveness will depend on the extent to which an individual identifies with others in the community (Bardhan 1993).

Finally, against our hypotheses, the proportion of marketed output had a negative influence on cooperation. This result implies that agricultural commercialization works against environmental cooperation in the research area. This could be explained by competition between different cooperation options in the community. The majority of the commercial farmers such as

those engaged in production of export crops and other high value commodities such as dairy indicated that they had memberships in farmer groups and cooperatives. Therefore, it could be that their engagement in enterprise specific cooperation prevented them from participating in the collective action activities addressed in this study.

5. Summary, Conclusion and Policy Implications

The objectives of this study were twofold. First the study sought to identify the cooperative behavior of sample households in the Lake Naivasha basin by assessing their degree of participation in activities involving voluntary provision of public goods in the community. Second, the study sought to identify the factors that make some individuals to either be cooperate or fail to co-operate when required to participate in community collective initiatives. The first objective was achieved through a two step cluster analysis procedure which was used to identify the category where each household belonged to given the observed previous degree of participation. Logistic regression was then used to identify the factors determining the probability of cooperation.

Results indicate that majority of the sampled households in the Lake Naivasha basin were non co-operators (61%). In line with theoretical expectations non co-operation was a dominant strategy in the Lake Naivasha basin case study just like in any other prisoner's dilemma situation. This is because self interested individuals tend to free-ride if this is possible and yields better individual results. Results from the logistic regression model indicate that the choice of the decision to cooperate or fail to co-operate was significantly influenced by expected benefits, human capital and labour endowments. Further, informal sanctions, norms of trust and attitudes/perceptions emerged as significant factors that are positively correlated with cooperation. These factors can be seen as catalysts that can be used to enhance cooperativeness and discourage non co-operation in the study area and in other watersheds facing a similar challenge.

From these results, we draw a number of implications that are relevant for policy. First, given that non co-operation was the dominant strategy in the basin, there is need for strategies to encourage cooperation so as to address agri-environmental issues effectively in the Lake Naivasha basin or any other similar watershed. This will also help to achieve substantial participation among the members of the community hence achieve substantial levels of

ecosystem services. Second, perceptions of watershed farmers could be boosted through campaigns and community education programmes that help to create awareness on environmental externalities associated with agriculture. Farmers should be made aware of the relationship between conservation and the long term productivity of their land, so that they can perceive that cooperation for the environment also creates private benefits. We are however aware that knowledge in itself may not necessarily lead to participation in collective action. Therefore, it calls for more deliberate efforts to create substantial incentives to encourage cooperation. Third, social sanctions can be encouraged by increased local participation in planning and resource management. This is a tool that should be used to achieve effective rule monitoring and enforcement at substantially low transaction costs.

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