



# Assessing the Level of Cooperation on Ensuring Sustainable Land Use Management in Naivasha, Kenya Between Water Resource Users Association and Water Resource Authority



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**Submission:** August 26, 2018; **Published:** September 17, 2018

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## Abstract

Lake Naivasha, one of the fresh water lakes within the Lake Naivasha Basin gets its recharge from the Aberdares water towers. The Lake Naivasha serves as the support system for the horticulture business. Market data from the Horticulture Department indicates overall sales rose from Sh216 billion in 2016 to Sh305 billion last year where the total value of horticultural produce exported in 2017 increased from Sh101.5 billion in 2016 to Sh115 billion last year. The beneficiaries from Lake Naivasha also create direct employment opportunities for over 30,000 people as well as benefiting above 350, 000 people indirectly.

**Keywords:** Aberdares water towers; Horticulture department; Livelihoods; Incentivized; Sustainable; Natural resource management; Socio-economic conditions

## Introduction

Lake Naivasha, one of the fresh water lakes within the Lake Naivasha Basin gets its recharge from the Aberdares water towers. The Lake Naivasha serves as the support system for the horticulture business. Market data from the Horticulture Department indicates overall sales rose from Sh216 billion in 2016 to Sh305 billion last year where the total value of horticultural produce exported in 2017 increased from Sh101.5 billion in 2016 to Sh115 billion last year (assessed on 24<sup>th</sup> August 2018, <https://www.businessdailyafrica.com/markets/marketnews/Horticulture-nets-Kenya-Sh305-billion/3815534-4489614-6hoeq4/index.html>). The beneficiaries from Lake Naivasha also create direct employment opportunities for over 30,000 people as well as benefiting above 350, 000 people indirectly. The Lake Naivasha also holds the lifeline of the unique and diverse rich biodiversity; private wildlife sanctuaries, National Parks which are great tourist's attraction equally important contributors to the national GDP. Rural communities depend on the lake for domestic water use and livestock as well as fish stocks for livelihoods. The huge geothermal power plant also depends on the Lake. The farmers through the introduction of Payment for Ecosystem Services have been incentivized to engaged in sustainable farm practices to ensure the lifeline of the lake Naivasha.

The Water Resource Users Association (WRUA), which is made up of an association of stakeholders, has the overall objective to facilitate all, stakeholders in the river sub-catchment with sufficient and good quality water supply, conserve the water catchment, to manage the resources properly, to preserve riverine forests and the riparian ecosystem and establish water use rules that are broadly accepted.

First, a WRUA needs to register at the regional WRA (Water Resources Authority) office, this ensures legal security for the WRUA. The WRA provides the WRUA with technical and administrative advisory and is part of the Ministry of Water and Irrigation. The members of the WRA conduct a water abstraction survey in the sub-catchment to identify all legal and illegal water abstractions.

The Naivasha Payment for Ecosystem Services (PES) initiative started with 565 pilot farmers, and this number has increased due to increased participation from members. There was evidence of poor cooperation between the WRA and WRUA, however the role of other intermediaries such as Wild Wide Fund for Nature (WWF) and Imarisha Naivasha has led to improved cooperation. Sustainable development is increasingly being presented as a pathway to avoid irreversible damages to natural capital [1,2]. The relevant aspect of sustainable development here

is the integration of socio-economic and environmental needs which requires the cooperation of people to balance needs. This is the thrust behind article 69 (2) of the Kenya Constitution. The central role of trust in coping with social dilemmas and a clear set of findings from the micro situational level have emerged regarding structural factors affecting the likelihood of increased cooperation [3].

Cooperation in natural resource management is key; there have been some studies conducted, for example [4], highlighted issues to do with downstream and upstream cooperation and the prevalence of common social issues. However, mistrust between stakeholders can be a barrier to cooperation over natural resource management [5]. Cooperation and emphasis on social as well as economic policies improve not only well-being, but also enhance many forms of public good [6]. The adoption of environmental initiatives is anticipated to provide a 'flow' of materials that can yield business satisfaction and increased production thus improved sustainability of the enterprise in question [7].

The study has shown that the majority of farmers are influenced to make sustainable land use choices. However, the variation in farmers' preference for PES practices is influenced by the socioeconomic attributes for specific PES interventions [8]. Lack of knowledge on existing conservation activities has been mentioned in a study conducted by [5]. The adopted practices restore farm productivity and improve production of other ecosystem services including water flow to support commercial investment downstream [8]. Knowledge about the socio-economic conditions and ecosystem services and experience with PES have a substantial impact on their willingness to invest in ecosystem services [9].

This study illustrated the cooperation between WRUA and WRA to ensure sustainable land use practices in Naivasha. It did so by examining knowledge of negotiation process, knowledge of protected areas, cost of agricultural inputs, knowledge of water regulation and impact of extension services. In the following, the methodology, results, discussions and conclusion are presented. This paper is part of my doctoral thesis.

**Materials and Methods**

**Study area**

The study was carried out in Wanjohi, Upper Turasha and Kianjogu catchments in the Lake Naivasha Basin. The study purposively selected the catchment areas identified for the PES scheme based on the biophysical features and established Water Resource Users Associations. The study used both quantitative and qualitative methods. 1143 PES farmers and 235 non-PES farmers were interviewed. The qualitative method was used to strengthen certain answers as addressed in the quantitative approach since respondents were allowed to provide their perceptions and opinions. The select target population was based on earlier work conducted by WWF in 2007. Hence the data and

size used were based on the WWF documents and available data. Key informants were purposefully identified to respond to policy questions. The key informants were Imarisha Naivasha (1); WWF (2); LANAWRUA (1); hotels (2); WRUA chairman (2); WRA (1) and Flower farms (1). The interviews were guided by interview guides specific for each main stakeholder group prepared in advance of the interviews. In all cases where the interviewee gave consent, the interviews were recorded. Otherwise detailed notes were taken. Hence its choice as a study site.

**Study Design Sampling and Data Collection**

Local institution (WRUA and WRA) are caught in conflict and trapped on either side of a snowdrift unable to communicate. They both want to get quality water and so they have the options to cooperate, i.e., to engage in sustainable practices and avoid conflict or to defect and engage in individual practices to achieve individual objectives hoping the other institution would work to ensure the quality of water. If both cooperate and engage in sustainable practices they have the benefit  $b$  of getting good quality water while sharing the labour  $c$  ( $b > c > 0$ ). Thus  $R = b - c/2$ . Whereas if both act individually they would not get anywhere before conflict increases and therefore  $P = 0$ . However, if only one institution engages, then both get increased water quality but the one that did not engage avoids the trouble and gets  $T = b$  whereas the diligent one is left with the whole work  $S = b - c$ . The resulting rank ordering of the payoff values is similar to the Prisoner's Dilemma except that  $P$  and  $S$  have a reverse ordering:  $T > R > S > P$ . Nevertheless, this leads to fundamental changes because now the best action depends on the behavior of the opponent: defect if the other cooperates but cooperate if the other defects.

**Data Analysis**

The qualitative information gathered through interviews and informal discussions was interpreted to complement the quantitative data. The quantitative data from the survey was organized in SPSS from where descriptive statistics were prepared to analyze the level of cooperation between the local institutions and farmers. Binomial logistics regression was used.

**Results and Discussion**

**Table 1:** Benefit of the Environment.

Benefit Environment.	N	Percent
Provision of biodiversity and conservation	716	20.7
Provision of water resources	742	21.5
Provision of Recreational services	407	11.8
Provision of livelihood improvement	826	23.9
Provision fodder	763	22.1
	3454	100

Conflict experienced is used here as the dependent variable. The majority (844, 61.4%) of the farmers indicated that they had experienced conflict. (530, 38.6%) of the farmers indicated that they had not experienced conflict.

The majority (826, 23.9%) of the respondents indicated that they benefit through the provision of livelihood improvement. (763, 22.1%) of the respondents indicated that they benefit through the provision of fodder. (742, 21.5%) of the respondents indicated that they benefit through the provision of water resources, such as the flower farms, subsistence farmers, industrial and domestic users. (716, 20.7%) of the respondents indicated that they benefit through the provision of biodiversity and conservation, such as the county and conservation agencies driving the agenda for increasing the tree cover and protecting flora and fauna and (407, 11.8%) of the respondents indicated that they benefit through the provision of recreational services (Table 1).

### Adoption rate of payment for ecosystem services (PES) practices

The majority (172, 73.2%) of the non-PES farmers indicated that they had adopted PES practices. (63, 26.8%) of the non-PES farmers indicated that they had not adopted PES practices (Table 2).

Table 2: Adopted PES Practices.

Adopted PES Practices	Frequency	Percent
No	63	26.8
Yes	172	73.2
Total	235	100

### Results: Level of cooperation between the water resource users authority and water resource authority:

Table 3: Regression on cooperation of WRUA.

	B	P Value	OR [ C I ]
Constant	-2.022	<0.001	0.13
<b>Process Negotiation</b>			
Strong Knowledge (RC)			1
Fair	-0.774	<0.001	0.46 [ 0.31, 0.7]
Neutral Knowledge	-1.187	<0.001	0.31 [ 0.2, 0.46]
<b>Knowledge Protected Area</b>			
No (RC)			1
Yes	0.919	<0.001	2.51 [ 1.7, 3.7]
<b>Cost Agricultural Inputs</b>			
High (RC)			1
Medium	1.203	<0.001	3.33 [ 1.98, 5.6]
Low	1.091	<0.001	2.98 [ 1.72, 5.16]
<b>Water Regulation</b>			
High (RC)			1
Medium	-0.233	0.341	0.79 [ 0.49, 1.28]
Low	-0.462	0.087	0.63 [ 0.37, 1.07]
<b>Extension Impact</b>			
High (RC)			1
Medium	2.586	<0.001	13.28 [ 5.43, 32.45]
Low	1.164	0.009	3.2 [ 1.34, 7.67]

In checking cooperation of members of Water Resource Users Association (WRUA) through regression, the study used a binomial logistic regression model, because the outcome variable was measured as a dichotomous (Yes/No). Regression analysis was chosen to analyze the independent variables: knowledge of water regulations; knowledge of Protected Areas; the impact of extension officers; knowledge of negotiation process; and the cost of agricultural inputs was regressed against the dependent variables conflict experienced. The regression analysis was used to test the nature of relationships between the dependent variables and the independent variables (Tables 3 & 4).

Table 4: Source Table.

Source:	
Nagelkerke R-Square	0.291
Reference Category	RC
Reference Category is Poor	
Odds Ratio	OR

The model produced a Nagelkerke value of 29%. Meaning the independent variables in the model explains 29% of the variation in the dependent variable that is conflict experienced.

Table 5: Knowledge of Negotiation Process.

knowledge of the protected area	N	Percent
No	250	18.1
Yes	1128	81.9
Total	1378	100

**Knowledge of negotiation process:** There was a significant association between conflict experienced and knowledge of negotiation process. Using farmers with strong knowledge of negotiation process as a reference point, farmers with fair knowledge of negotiation process were 54 percent less likely to experience conflict, similarly, farmers with no knowledge of negotiation process were 69 percent less likely to experience conflicts as compared with farmers with strong knowledge. As the number of farmers with no knowledge of negotiation process increases, the likelihood of experiencing conflicts increases (Table 5).

The study shows a general poor knowledge of negotiation process (530, 46.4%) between the Water Resource Users Association at the upper catchments and the beneficiaries at the downstream catchments.

Table 6: Knowledge of Protected Areas.

knowledge of the protected area	N	Percent
No	250	18.1
Yes	1128	81.9
Total	1378	100

**Knowledge of the protected area:** With No knowledge of protected areas as the reference point, farmers who stated they

have knowledge of the protected area were 2.51 times as likely to experience conflicts as compared with farmers who do not have the knowledge of protected areas (Table 6). The study shows that majority of the farmers had knowledge of protected areas (1128, 81.9%) especially on issues of riparian lands.

**Cost of agricultural inputs:** With the high cost of agricultural inputs as a reference point, farmers with the medium cost of agricultural inputs were 3.33 times as likely to experience conflicts as compared to farmers with the high cost of agricultural inputs. Farmers with low cost of agricultural inputs were 2.98 times as likely to experience conflicts as compared with farmers with the high cost of agricultural inputs (Table 7). The study shows that majority of the respondents stated a relatively higher cost for agricultural inputs (790, 57.3%) especially on issues of farm implements (tree seedlings and fertilizers).

**Table 7:** Cost of Agricultural Inputs.

Cost agricultural inputs		
	N	Percent
High	121	8.8
Medium	790	57.3
Low	467	33.9
Total	1378	100

**Knowledge of water regulation:** With high knowledge of water regulation as the reference point, there was no significant association between medium knowledge of water regulation and experiencing conflicts, however, farmers with medium knowledge of water regulation are 21% times less likely to experience conflicts and farmers with low water knowledge of water regulation are 37% less likely to experience conflict as compared with farmers with high knowledge of water regulation (Table 8). The study shows that majority of the respondents had relatively high knowledge of water regulations (694, 50.4%) especially on issues of water abstraction levels, common intake points and some policies regarding water uses on the farms and the required fees.

**Table 8:** Knowledge of Water Regulation.

Knowledge of Water Regulation		
	N	Percent
High	178	12.9
Medium	694	50.4
Low	506	36.7
Total	1378	100

**Impact of extension officers:** Farmers with Medium impact from extension officers are 13.28 times as likely to experience conflicts as compared with farmers with High extension impact. Again, farmers with low impact from extension officers are 3.2 times as likely to experience conflict when compared with farmers with High extension impact (Table 9). The study shows that majority of the respondents had complained about the low impact of extension officers (826, 59.9%) especially on issues

of technical advice and support regarding the Payment for Ecosystem Services which is to result in sustainable land use practices.

**Table 9:** Impact of Extension Officers.

Impact Extension		
	N	Percent
High	52	3.8
Medium	500	36.3
Low	826	59.9
Total	1378	100

### Discussions on the level of Cooperation between the Water Resource Users Authority and Water Resource Authority

Cooperation is widespread in the real world and requires different levels of the organization. Cooperation is also the decisive organizing principle of human societies. Therefore, the underlying mechanisms of cooperation are much needed and have been investigated extensively in different contexts [10].

The snowdrift dilemma supports the objective 2 of the PhD thesis in addressing the current status of cooperation between stakeholders (Water Resource Users Association and Water Resources Authority). According to Kummerli et al. experiment on human cooperation showed that the proportion of cooperative acts is significantly higher in the Iterated Snowdrift than in the Iterated Prisoners Dilemma. The snowdrift game presents optimal cooperation payoffs matrix as compared with the Prisoners Dilemma which rewards parties for non-cooperation. Snowdrift is therefore the suitable theoretical framework for the study of cooperation, and individuals in such game can gain access to benefits for the pair at one individual cost.

**Knowledge of negotiation process:** The unsustainable land use practices to generate more revenue at the expense of sustainable practices, led to the change in focus to strengthen sustainable management and policy outcomes to deliver more integrated policy and management at a landscape scale directed towards human wellbeing [11], and livelihood benefits [12]. Hence the negotiation process.

Majority of the respondents indicated that the water quality after PES was average. This is attributed to the fact that, change in ecosystem enhancement takes time. For the impact of the intervention on the quality of water to be felt, this will take a number of years. Not within the study time frame. In many countries land ownership and resource tenure are unclear, with land and resources technically still owned and managed by the state; and overexploitation of natural resources due to resource grabs and corruption [13]. The negotiation process was not very clear as the members representing the farmers were not able to explain the details of the contracts and what was required of the community clearly. There seems to be a high number of respondents who did not to understand the negotiation process

clearly and this initially affected cooperation between the WRUAs and WRA. However, there has been repeated capacity building towards the farmers and other community members on the contracts signed between the WRUA and LANAWRUA.

**Protected areas:** To enhance the environmental sustainability of natural resources, altering land use has been considered as one of the viable options. Hence the adoption of the PES scheme which has resulted in some positive outcomes such as improved household incomes and farming practices. Empirical evidence on the success of implementing Integrated Conservation Development Programs (ICDP) by altering land use changes remains mixed, though, said to improve the economic livelihoods of some people living near or in protected areas [14]. Alternative land-use change that conserved the natural resources is best for regulating ecosystem services [15]. This is evidenced as a result of the perceived water quality of the Lake Naivasha. Planting of trees to protect the riparian land has been successfully adopted by the community [16]. Managing landscapes requires the development of effective partnerships [17]. As is being established by the WRUA and WRA. Protected Areas usually contain existing human settlements with unclear property rights, as is often observed in other countries [13]. The high level of threat to the natural habitats means that some of these areas are of the highest urgency for conservation. Institutional failure is problematic for implementation of a PES program to protect biodiversity for some reasons such as poorly defined property rights makes it challenging to determine whom to pay, contracts cannot be legally enforced, elite capture is common, and enforcement of laws (e.g., prohibiting land clearance) may be weak.

Informal discussions with the PES farmers stated the importance of land ownership in making sustainable land use decisions. This implied that farmers who relied mostly on sufficient authority from household heads as the main source of documentation clearly defining boundaries were less likely to have decided to participate in sustainable land use management unlike those with title deeds. Land ownership or resource tenure is clearly defined and protected by law [13]. However, according to [13], not all, PES programs have been established in situations where property rights are clearly defined, although other aspects of the institutional framework may be weaker. The experience of conflict was based on lack of cooperation, as farmers before the introduction of PES did not have a better understanding of conservation management. Other farmers interviewed thought it was one of the government's attempt to grab the land as has been some of the customs of the elite in society. Conflicts occurred between household members verbally abusing each other given the lack of understanding of resource management. However, this practice changed drastically when the sustainable farming practices were introduced with the advent of the PES scheme in 2007, which included both parties cooperating.

**Water regulation:** It was noted that most of the water users are abstracting the amount of water allocated within their

permits and this was evident during the abstraction survey. This was not the case in the past as the rate of illegal abstraction was high. The WRUA in cooperation with the WRA seized and destroyed all illegal equipment found at the abstraction points. The common in-take was introduced to effectively regularized water usage. This demonstrates very well that the abstractors are becoming more responsible. It is now evident that when customers want to drill boreholes they come to WRA office and enquire on the process. This has enabled WRA to know where the boreholes are to be drilled and also be able to collaborate with WRUA to supervise the works and ensure that the piezometers are installed as required by the WRM Rules 2007.

**Role of Extension officers:** The role of the extension officers is to provide capacity building and monitor the impact of the farmers based on the PES scheme, hence, the cooperation between the extension officers from an institution, is an indication of both parties working to achieve a common goal. However, lack of funding to engage these extension officers has resulted in some farmers not benefiting. Though, resulting in low toned conflict, the role of WWF has helped enable most of the farmers increased their knowledge of both protected areas and water regulation. As the impact of the extension services increases, the likelihood of experiencing conflicts reduces. There is the need to provide adequate funding for the extension officers to provide their services to the farmers.

### Conclusion

To cooperate involves having a better understanding of the dynamics of the PES program, having the required knowledge and information through training or capacity building. Enhanced cooperation between Water Resource Users Association and Water Resource Authority is beneficial, as, given the variables above, a high number of PES adoption rate by the non-PES farmers has increased sustainable farm practices hence, reduced conflict and improved water quality. Majority of the respondents indicated that they benefit through the provision of livelihood improvement as a result of increased yields from the farm sales. Other stakeholders benefit as a result of improved water quality.

Cooperation between these agencies and with support from WWF and Imarisha Naivasha has increased the understanding of resource management and also led to a reduction in conflict. Cooperation mechanisms for WRUA and WRA monitoring land use are a means to address the increasing complexity of land use management.

The study concludes now that, the cooperation between the WRUA and WRA, has resulted in improved revenue collection as a result of collaborated efforts. The WRUAs are able to identify all water users within the community. The revenue for 2015/2016 dropped by 35% compared to the previous year following a water abstraction survey which was also used to educate water users and revise the water use categories (Unpublished World-Wide Fund for Nature data). The key outcomes were that most users were classified as category B yet they were actually in A

and therefore should pay less (Key informant information). Due to education compliance and understanding by the water users has risen suddenly and thus reducing revenue from defaulters in the form of penalties [18-20]. While this is still at a very low scale comparative to the total area of the basin, vegetation cover is slowly increasing, and it is anticipated that, in the long-term, increased vegetation cover will play a critical role in regulating the various ecological cycles, especially in the water cycle which are critical for both the social economic sustainability and environmental conservation in the basin.

A statement made by a Kenya Wildlife Service official stated this about the institutional arrangement which is coordinated by Imarisha Naivasha. The official stated that even though attempts are made on how these agencies can cooperate to achieve the objective of water quality, there seem to be some institutional challenges. However, there is some progress made with the intervention of Imarisha Naivasha, WRA and WRUA in regulating water abstraction by the stakeholders.

On the issue of the level of cooperation between the stakeholders, it is recommended that a functional platform for communication is created to increase the participation of extension officers and enrollment of the farmers to adopt sustainable agricultural input. There is also the need to build a strategic framework and action plan for cooperation with inputs from the ecosystem service suppliers (WRUA), the ecosystem buyers (LANAWRUA) and the intermediaries (WWF, Imarisha Naivasha). With the water Act 2016, the involvement of the county government is key in enhancing institutional cooperation. It is also recommended that further studies be conducted using the snowdrift dilemma to apply the institutional framework so that institutions could optimize stakeholder cooperation and provide safeguards to protect land use and ecosystem services.

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DOI: [10.19080/ETOAJ.2018.02.555590](https://doi.org/10.19080/ETOAJ.2018.02.555590)

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