ASSESSING THE EFFECTIVENESS OF PAYMENT FOR ECOSYSTEM SERVICES IN KENYA: A CASE STUDY OF LAKE NAIVASHA BASIN

A Thesis Submitted to the University of Nairobi in Partial Fulfillment of Doctor of

Philosophy Degree in Environmental Governance and Management

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This thesis is the original work and has not been presented for a degree in any other university.

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JACOB KWAMINA DODOO

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DEDICATION

This thesis is dedicated to my parents, Dr. Jacob Kwamina Dodoo and Mrs. Hannah Dodoo, my ever loving wife Cynthia Akosua Antwi, for her patience and support. My children, Jessica Efua Dodoo and Jacob Kweku Dodoo.

ACKNOWLEDGEMENTS

LIST OF ACRONYMS

ES	Ecosystem Services
EMCA	Environmental Management and Coordination Act
FGD	Focus Group Discussion
Ha	Hectare
HH	Household
KI	Key Informant
KWS	Kenya Wildlife Service
LANAWRUA	Lake Naivasha Water Resource Users Association
LNRA	Lake Naivasha Riparian Association
LNB	Lake Naivasha Basin
LN	Lake Naivasha
MoU	Memorandum of Understanding
PES	Payment for Ecosystem Services
SCMP	Sub-Catchment Management Plan
SDG	Sustainable Development Goals
UNEP	United Nations Environmental Programme
UN	United Nations
WWF	World Wide Fund for Nature
WRUA	Water Resource User Association
WRA	Water Resource Authority

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ABSTRACT

Many case studies have generated some evidence that PES approaches can lead to positive outcomes. There is evidence of slow uptake of PES in Africa as a result of institutional weakness. This study was conducted to assess the status of land use management; to access the current status of cooperation between institutions and society; to analyse the governance context regarding regulation; and recommend policy modification that can enhance the PES scheme to result in sustainable land use practices.

Primary data obtained from farmer's survey involved 1378 farmers selected among PES and non-PES member farmers residing within the Wanjohi, Upper Turasha and Kiambogu catchment areas. Secondary data included a review of water legislation, published journals and grey literature.

The study showed that the mean farm size is 3.35 acres, where the minimum is 1 acre, and the maximum is 35 acres. There is a general knowledge of water regulations and protected areas (for example riparian areas). There is a significant relationship between conflict experienced and the impact of extension services. The conflict experienced within the study area was based on lack of cooperation, as farmers before the introduction of PES did not have a better understanding of conservation management. There was also a strong significant association between committee importance and water quality.

The study showed that majority of the farmers have title deeds. This is attributed to the significant knowledge of protected areas and the need to adopt sustainable land use practices to protect the natural resources. The study also showed that enhanced cooperation is beneficial, as, given roles of the extension service by the county government to support the farmers. Though, the extension officers are faced with some challenges, the introduction of the Water Act 2016, highlights the issue of participation in the management of the natural resources by the county. The study also showed the importance of committee in managing the PES schemes. However, there is a need for PES specific policies to ensure the sustainability of the PES schemes.

1 INTRODUCTION

Kenya has been one of the African countries to undertake a Payment for Ecosystem Services (PES) program, to protect waterbodies within the Lake Naivasha Basin (LNB). The program in Naivasha, Kenya, started in 2007 and included a diverse group of land users (farmers, hoteliers, commercial and industrial users) to engage in sustainable land use practices. To encourage sustainable land use practices, payment was granted on a yearly basis to farmers at the upper catchments after the signing of the contract between the Water Resource Users Association (WRUA) and Lake Naivasha Water Resource Users Association (LANAWRUA). Thus, making PES an increasingly popular tool for environmental management (Ezzine-de-Blas *et al*., 2016).

Current findings have established that PES can lead to positive outcomes (Smajgl *et al.* 2015; Nduhiu *et al*., 2016;). These outcomes include regulating water bodies, reducing conflicts within the farming areas and the adoption of sustainable land use practices. However, 38 case studies on the effectiveness of PES examined stated that PES was still weak (Gaworecki 2017). PES conditionality includes negotiating contractual payment to ecosystem providers to achieve an environmental outcome (Wunder 2005; Ezzine-de-Blas *et al*., 2016). Such as, "The International Small Group and Tree Planting Program (TIST)," "Kitengela wildlife conservation lease program," both in Kenya (Ferraro 2009). There is a slower uptake of PES programmes in Africa because of lower technical resource capacity to organize such schemes (Ezzine-de-Blas *et al.* 2016; Soares-Filho *et al*. 2016). This can be attributed to land tenure issues such as title deeds, institutional weakness and lack of cooperation between the institutions and society and also the lack of PES specific policies. There is a need for different policies when externalities are occurring (Ezzine-de-Blas *et al*. 2016).

In Kenyan, several studies have reported on PES to improve land use (Nyongesa 2011). This is based on the fact that, the region sometimes suffers from devastating droughts (USAID 2012; Murungweni *et al.* 2015). Wetlands for which LNB is one, are critical natural resources which provides benefits to local communities (Dixon and Wood 2003). According to (Schuyt 2005), 14 countries in Africa are subject to water scarcity, and Kenya, a water scarce country has only 647 cubic meters of renewable freshwater per capita, (Moraa 2012).

Further studies on LNB are required, and an improved understanding of the interaction between LN and changing patterns of land use is important (Everard *et al.* 2002). Stakeholder involvement and the management of the lake within the LNB is poorly studied (Harper *et al.* 2011). (Mulatu *et al.* 2013), highlights intense land utilization and informal settlement due to lucrative economic activities as factors contributing to poor land use management. According to (Ezzine-de-Blas *et al.*, 2016), studies have underscored the way governance has influenced the design and effectiveness of PES programs, thus, this study provides a clear understanding of sustainable land use management.

The chapter is structured as follows: Statement of the Research Problem; Research Objectives, Research Questions, Justification, Scope and Limitations and lastly is the chapter outline of the Thesis.

1.1 STATEMENT OF RESEARCH PROBLEM

The recent developments around the LNB reveal some issues that are of institutional and policy relevance, which constitute an interesting case for natural resource management. Upstream land use activities are incompatible with downstream uses of the lake and affect both water quality and quantity. Additional to these challenges are conflicts around access to water.

The relationship between upstream and downstream water users are poor but their interdependent circumstances that is poor "water quality" benefits from PES. The benefit associated with this collective action allows for the sustainable management of common resources such as water. The challenge in LNB is to create substantial incentives for individuals to join and participate in the water user groups, that is, overcoming free rider problems. The complexity of institutional arrangement makes the management of PES programs difficult. There is a need for institutional improvements in LN to support the functioning of PES by addressing the problems as a result of rules and regulation making it difficult for effective management of PES and encouraging sustainable land use management.

There is the need for upstream users to generate benefits that could attract continuous payments from the downstream users and this might create incentives for users to adopt sustainable farm practices to ensure the effectiveness of PES. The lack of PES policy has resulted in the poor enforcement of regulations (Water Resources Authority rules 2007). The Water Resources Authority (WRA) poorly enforces this as they lack the capacity and resources on the ground to undertake such assignments and also monitoring of water users.

In an ideal setting with best agricultural practices, the water quality would be improved, and there would be cooperation among institution and society. Hence, the rationale of this study is to focus on the farmers and other stakeholders' contribution to biodiversity and habitat protection by ensuring they engage in sustainable forms of land use practices.

The applicability of best practices for PES in a rural setting is explored, informed by the reasoning in scholar Elianor Ostrom's eight principles of managing the commons (Ostrom 1990),

further assessed in chapter 4, 6 and 7. The study also examines how the interests of all stakeholders, can enhance cooperation to optimize benefits and institutional arrangement to ensure the effectiveness of PES. For this, we apply the game theory, through the snowdrift sub-theory to examine the question of cooperation, as guided by the research objectives set out below.

1.2 RESEARCH OBJECTIVES

The overall objectives were to assess the effectiveness of PES services in Naivasha.

Specific objectives are:

1. To assess the status of land use management of the LN catchment area and how it impacts on the water quality;

2. To assess the current status of cooperation between stakeholders;

3. To analyse the PES governance context regarding regulation (law, policy, and institution) set up for good governance and implementation as informed by Kenyan law and policy; and

4. To identify gaps in the Kenya law and policy framework on PES and make policy recommendation to enhance sustainable land use practices.

1.3 RESEARCH QUESTIONS

The following research questions will address the research problems stated above.

1. Is the current status of land use management sustainable or not and how does it impact on the downstream water quality?

2. How is the current status of cooperation between stakeholders?

3. How is the PES governance context, regarding regulation (law, policy, institutional) context set up for good governance and is it implemented well?

4. What are the gaps in the Kenya law and policy framework on PES and what policy recommendation are needed to enhance sustainable land use practices?

1.4   JUSTIFICATION

Weak institutions where property rights are not clearly defined (Clements *et al*. 2010) results in poor land use management, which then results in conflicts and poor water quality and quantity. However, effective policies are required to address the change in the scale of land use. Such findings are important in addressing aspect such as the social, economic and scientific importance within the LNB. Various strategies such as market-based incentives, non-market based incentives, and PES have been used to address environmental issues. However, PES has gained support from local government and communities as an incentive mechanism (Fauzi and Anna 2013). The study is justified at the global, regional and national levels.

At the global level, SDG Goal 15 supports the PES scheme by protecting, restoring and sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. SDG 6 supports PES scheme through the sustainable management of water resources and access to safe water and sanitation as essential for unlocking economic growth and productivity. The natural environment e.g. forests, soils and wetlands contributes to management and regulation of water availability and water quality, strengthening the resilience of watersheds and complementing investments in physical infrastructure and institutional and regulatory arrangements for water access, use and disaster preparedness. At the regional and national levels,

to support the types of ecosystem services, specifically, for purposes of this study, issues on provisioning and regulatory.

1.5   SCOPE AND LIMITATIONS

The scope of this research covered the management of land use in the upper catchments of Wanjohi, Upper Turasha, and Kianjogu. The greatest challenge in the data collection process was the lack of continuous hydrological and abstraction data from WRA. The publicly available data on population is dated and is more than ten years. Unfortunately, detailed statistical data on population, agriculture and social economics at sub locations and district level are limited.

A field analysis conducted did not provide enough information about the status of land use, the cooperation among institutions and PES governance. The knowledge of water regulations, protected areas and process negotiation was examined for the first to third objectives.

To address the objectives stated above, we focused on title deeds, cost of agricultural inputs and the impact of extension services in land use management within the LNB.

The issue of PES governance focused on committee importance in addressing water quality.

1.6   STRUCTURE OF THIS THESIS

This thesis is organized into eight chapters.

1. Chapter one presents a general introduction to the study.

2. Chapter two provides a comprehensive literature review on Land use management, PES governance focusing on the institutional arrangement and policy modifications. The theoretical framework is made up of the Ostrom's eight principles for managing the

commons and the game theory which highlights the sub-theory on snowdrift dilemma, the research gaps and finally the chapter summary.

3. Chapter three reported on the research methodology used, by highlighting the study areas, the conceptual framework, regression, the sampling size and the chapter summary.

4. Chapter four presents findings on Payment for Ecosystem Services (PES) in managing land use.

5. Chapter five presents findings on the level of cooperation between stakeholders.

6. Chapter six presents the governance of the Payment for Ecosystem Services (PES) in the Lake Naivasha Basin (LNB).

7. Chapter seven, presents gaps in the Kenya law and policy framework on Payment for Ecosystem Services and makes recommendations on how to enhance the policy framework in order to improve stakeholder cooperation that results in changed land use practices upstream, and improved quality and quantity of water downstream.

8. Chapter eight, contains the final conclusions and the recommendations arising from the thesis.

2   LITERATURE REVIEW

The literature review is structured to allow for the analyses to address four (4) research questions that inform the thesis. Firstly, the status of land use management sustainability; secondly, cooperation between institutions and society; thirdly, the PES governance context, regarding regulation for good governance and finally identify gaps in the Kenya law and policy framework on PES and make policy recommendation to enhance sustainable land use practices. Based on the snowdrift theory, the review focused on the relationship with process negotiation, knowledge of protected areas, knowledge of water regulation, extension impact and cost of agricultural inputs.

2.1   PAYMENT FOR ECOSYSTEM SERVICES IN MANAGING LAND USE

Upstream land users are involved in diverse activities to generate income. Studies have shown that the promotion of environmentally sustainable activities can lead to improved water quality and positive adaptation benefits for both service providers and service buyer (Van de Sand *et al*. 2014).

Studies conducted in Rwanda, highlighted the decline in ecosystem services as a result of human activities (Andrew and Masozera 2010). The study also found the destruction of protected areas for example volcanoes natural park, Nyongwe forest, Gishwati forest and Mukura forest reserve resulting in soil erosion and sedimentation leading to water scarcity (Andrew and Masozera 2010).

Most PES projects are in response to water or biodiversity as the principle ecosystem service. A key challenge is how ecosystem service suppliers can prove to buyers that their activities are

generating benefits. The benefits of an ecosystem service work relatively well in inducing service provision, (Jack *et al*. 2008), as the ecosystem asset provides future ecosystem services (White and Hanley 2016). The effect of PES programs on the behavioral aspects of the farmers influences the effectiveness of PES (Le Velly and Dutilly 2016).

The objective of the PES program is to enhance the provision of ecosystem services through agricultural technology to reduce soil erosion (Le Velly and Dutilly 2016).

In Kenya, Naivasha, some practical obstacles may hinder PES implementation such as the adequacy of property rights and issues of trust (Bremer *et al*. 2014; Hejnowicz *et al.,* 2014; Solazzo *et al.* 2015).

2.2 COOPERATION BETWEEN STAKEHOLDERS

PES has relevance where there are trade-offs between upstream landowners and downstream water users' owners (Wunder 2013). Where users' willingness to pay falls short of providers' willingness to accept compensation, PES will not be possible (Wunder 2013). PES schemes creates institutional settings for easing downstream-upstream cooperation and promoting conflict resolution (Kronenberg and Hubacek 2013; Suhardiman, *et al* 2013; Bladon 2014; Hecken and Baker 2015; Muniz and Cruz 2015; Wegner 2015;).

Increased understanding of the perceptions of the local population about the challenges of the ecosystem restoration may also be a valuable tool for the design and implementation of projects (Brancalion *et al*. 2013).

The objective of the cooperation is to collectively enhance the natural resource and ensure the sustainability of the land use practices. Thus reduce transaction cost as a result of environmental

monitoring, which is crucial but must be linked to ecosystem service (Paavola and Hubacek 2013). Hence the need to ensure that human impacts on the lake and its resources are moderated (Otianga- Owiti and Oswe 2007). Upstream landowners enjoy the privileged position of free riding (Jack *et al*. 2008). Cooperative water management policies were analysed using game theory (Kahil *et al*. 2016).

2.3   PAYMENT FOR ECOSYSTEM SERVICES GOVERNANCE CONTEXT REGARDING REGULATION

There is the need for institutional coordination to avoid contradictory policies. Studies should explore the roles, and perspectives of actors involved in decision making across institutional arrangements (Andrew and Masozera 2010; Kerr *et al*. 2014;).

Governance and institutions, as two concepts, are closely interlinked (McFadden, Priest, and Green 2010). Where enforcement of institutions is limited, there is the likelihood that rules will be disobeyed (Agrawal 2003). This is the result of weak institutions (Clements *et al*. 2010).

In Kenya, Naivasha, the concept of water governance has received increased attention (Lemoine and Patrick 2014). The key question is whether 'institutions in the management of PES to the stakeholders and ecosystem are effective enough to ensure the sustainability of the LN. Hence, there is the need for communities to contribute to sustainable ecosystem governance (Lin *et al*. 2013).

A study conducted by (Lin and Nakamura 2012), found that improved institutional arrangements have significant potential for an integrated ecosystem-based PES designs. Therefore, good governance is promoted through transparency, accountability, and participation (Bennett and Dearden 2014).

Table 1: Stakeholders Engagement

Stakeholders	Engagement
Hotels	Promote tree planting activities
Imarisha Naivasha	Responsibility for Coordination. Establish an enabling environment in the basin for Networking, collaboration, conflict resolution and harmonization of various interests as well as linkages with the County and National governments as well as at global levels
WRA	Water Resources Authority (WRA) is a state corporation established under Section 11 of the Water Act, 2016. Under Section 6 of the Act, the Authority is an Agent of the National Government responsible for regulating the management and use of water resources. The Water Act, 2016 makes extensive provisions on the Authority's role in regulating the use and management of water resources.
LANAWRUA	Downstream stakeholders contribute to the upper catchment farmers
WWF	Facilitate the activities to promote PES
WRUA	Means on-farm soil and water conservation, rehabilitation, and management of riparian land, on-farm tree planting, rehabilitation of degraded sites, monitoring of silt loads in river water
Flower Farms	Promote tree planting activities
Others	Promote tree planting activities

2.4 POLICY GAPS IN THE KENYAN LAW AND POLICY FRAMEWORK ON PAYMENT FOR ECOSYSTEM SERVICES

In developing countries, especially Africa, attempts at implementing PES has not reached the expected targets, both in reducing poverty and strengthening social justice, because of numerous pitfalls to effective policy design. Vietnam is one of the first countries worldwide who applied a PES policy that regulates payments from tourism, where tourist service providers benefiting from forest environment services make a fixed payment (Hieu *et al.,* 2017). Hence, there is the need to design policy and institutional arrangements around PES programs (Andrew and Masozera 2010).

PES schemes in Africa are slow because of lower resource capacity to organize PES schemes (Ezzine-de-Blas *et al*. 2016a; Soares-Filho *et al.* 2016). A mix of policies is needed when externalities are occurring together with imperfect property rights, unobservable behavior or imperfect information (Ezzine-de-Blas *et al*. 2016). The Constitution of Kenya has enacted certain laws that would address the current situation and to protect the environment given the supporting regulations. The original position of LNB was that of unsustainable land use, poor property rights and conflict within the catchment areas. However, Article 42, of the Constitution provided for the protection of the environment. Article 69, emphasized sustainable exploitation, conservation of the environment and natural resources, participation and elimination of activities that are likely to compromise the environment. Article 69 also mentioned cooperating with state institutions and other stakeholders to ensure ecologically sustainable development and use of natural resources. Article 66 makes provision for the regulation of land use and Article 70, highlights the enforcement of environmental rights.

On the issue of PES governance, the Kenyan constitution addressed the issue of democratically elected representatives at both national and county levels. Article 10 (2), provided the principles of governance to include devolution of power, the rule of law and participation of the people. These values are important as they relate directly to the issue of trust, which has an impact on how the WRUA perceive the functions of the executives.

The lack of PES policy has resulted in the poor enforcement of regulations (Water Resources Authority Rules 2007). Here, Article 43 (3) states that the WRA may take any appropriate measures for enforcement including the confiscation of equipment. The WRA poorly enforces this as they lack the capacity and resources on the ground to undertake such assignments and also monitoring of water users.

2.5 THEORETICAL FRAMEWORK

The chapter presents a conceptual framework that summarizes the problem context and provides the interventions that would result in the desired outcome. Discussions on the theories are below.

2.5.1 Ostrom's Eight Principles for Managing Commons

The principles used for this study are 1, 2, 4, 7 and 8. We found that these individual components often made important contributions to the outcomes of cases and conclusions of studies. The thesis eventually utilizes some, not all of Ostrom's principles (Ostrom 1990) due to context applicability (clearly defined boundaries, congruence, choice arrangement, monitoring, conflict resolution mechanism and minimal recognition rights to organize, because they are all supported).

Table 2: Ostrom's Eight Principles Context Applicability

Description	PES applicability	Supported (Y/N)
Clearly defined boundaries are important design principle for successful collective action (Ostrom 2011).	Key criteria that are needed to define land ownership document type.	Y
The 'fit' or 'congruence' principle.	Specifies the importance of matching rules to the characteristics of resources and resource users.	Y
Collective-choice arrangements (Ostrom 1990).	Members must work together to agree upon the conditions of the arrangement (Kerr *et al*. 2014).	N
Monitors	Actively audit Common-Pool Resources conditions and appropriator behavior.	Y
Graduated sanctions.	Ensure flexibility to punish repeat offenders (Ostrom 1990).	N
Conflict-resolution mechanisms	To enable appropriators and officials to resolve conflicts (Ostrom 1990).	N
Minimal recognition of rights	To organize must be able to design at least some of their own rules without being undermined by higher-level authorities (Ostrom 1990).	Y
Nested enterprises.	The local governance systems to be integrated into higher-level governance structures (Ostrom 1990).	N

2.5.2   Game Theory

Game theory explores ways in which strategic interactions (cooperative or non-cooperative) produce outcomes concerning the preferences of the agents, for example, watershed management decision-making (Madani 2010). Game theory predicts the expected behavior of rational individuals in such well-specified situations and theorist had to posit the following action situation: a set of participants; positions they hold; cost and benefit assigned to actions and outcome; the amount of information; payoffs; transformation and outcome (Ostrom 2010). Here, we consider and assess two sub-theories of the Game Theory: prisoner's dilemma and the snowdrift dilemma.

2.5.2.1   Prisoners dilemma

In Prisoner's Dilemma two players (A and B) have been put in prison by player C. The player C do not have sufficient conviction evidence, and so have separated the player A and B to prevent them communicating. The Player A and B are given an incentive to cooperate with player C. Each prisoner (either A or B) has the option of confessing or remaining silent. If one prisoner confesses while the other remains silent, the betrayer will get a reward and goes free and the silent prisoner is convicted and sentenced based on the other prisoner's evidence. In this case, the silent prisoner should stay in jail for a long period because of the crime and his non-cooperative behavior. If both prisoners remain silent and do not confess they will be released after a short time because of insufficient evidence for conviction. However, if both parties confess they both serve sentences. In the latter case, the period each prisoner stays in jail is shorter than the case in which one prisoner should go to jail because of remaining silent while the other prisoner

confesses. The fundamental prisoner's dilemma is whether to trust the silence of his colleague or to trust the reduced sentence the player C offer from betraying his colleague.

2.5.2.2   *Snowdrift dilemma*

Snowdrift game is usually applied where the element of cooperation comes into play. According to (Bshary et al. 2016), mutual, conditional helping does not in itself provide evidence for an Iterated Prisoners Dilemma, as the same pattern may emerge in an Iterated Snowdrift game. Both games represent social dilemmas, in which defectors are prone to exploit cooperators, and have an advantage over cooperators. However, 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 (Ma et al. 2013).

The snowdrift dilemma supports the objective 2 in addressing the current status of cooperation between institutions and society. According to (Kummerli et al. 2007), 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.

2.5.2.3 Conclusion on Snow Drift Dilemma

Aldo Leopold's example added a distinctive new component to conservation, where the mutually beneficial relationship, prompts participation in environmental management (Leopold 2004). The Land Ethic, as stipulated by Aldo Leopold argues in favour of a symbiotic relationship that depends on cooperation.

The snowdrift dilemma therefore reflects the reality of human cooperation unlike the prisoners' dilemma, hence the choice of this sub-theory. The theory supports the second objective as it assesses the relationship between upstream as they have privilege "to access" and downstream users as their interdependent circumstances that is poor "water quality" benefits from PES. The benefit associated with this collective action allows sustainable management of natural resources. However, the challenge is to create substantial incentives for the management of the natural resources.

2.6   RESEARCH GAPS

Previous to this study, there was lack of information on land ownership document type, cooperation between institutions and society and PES governance in the LNB, although needed to guide policy and institutional arrangement in improving PES implementation.

1. PES schemes are supposed to induce upstream stakeholders to take downstream effects into account when making decisions about their land use. Decision making on land use is problematic, given that property rights are not clearly defined and as such more research is needed to test the relationships between property rights and land use variables such as Knowledge of Protected Areas, Knowledge of Water Regulations and Knowledge of Negotiation Process.

2. The need for coordination between different actors is challenging, thus calls upon communities to coordinate and create institutions to contribute to sustainable ecosystem governance (Lin *et al*. 2013).

3. There is need to move forward with the formation of committees, which follows the argument of (Ostrom 1990), the power to create rules and enforce rules, the power to determine who can and who cannot use resources, the power to implement and ensure compliance.

4. Devolution is a policy and process that has the potential to improve local livelihood and enhance decision making. The need to develop policies to address local and regional institutional frameworks that can cope with complexity and diversity and integrate PES within other policy instruments for environmental protection is critical (Muradian and Rival 2010). There is a lack of policy framework specific to PES, however, the Sessional Paper No. 1 of 1999 under the title "National Policy on Water Resources Management and Development" as the principal policy framework for Kenya's water sector reform process (Mumma *et al* 2011), tackled issues pertaining to water resources management, however, the lack of clarity with regards to institutional framework, resulted in the policy not achieving its maximum potential.

2.7   CHAPTER SUMMARY

This chapter discussed the Ostrom's eight principles of managing the commons and identified six principles that the study saw as a fit. The snow drift dilemma adopted over the prisoner's dilemma was because of the concept of cooperation.

The need to test the relationships between land use and the provision of environmental services on which PES schemes rely upon was highlighted. There is the need to examine the snowdrift dilemma in natural settings. There is a need for coordination between different actors, and there is the need to develop policies to address local and regional institutional frameworks that can cope with complexity and diversity and integrate PES within other policy instruments for environmental protection is critical.

Public participation in PES though low in developing countries (Ezzine-de-Blas *et al*. 2016), the Kenyan constitution, Article 69 highlights the need to ensure sustainable exploitation through public participation in management including collaboration with agencies and other stakeholders. Article 69 also involves cooperation in achieving the same output by developing governance structures through representation in decision making (such as committee formation). The snowdrift theory adopted highlights cooperation among agencies and other stakeholders.

3   RESEARCH METHODOLOGY

This chapter articulates the specific research methodology applied for this research, and for addressing the research objectives previously set out in Chapter 1. These are submitted in the form of papers.

The methodology in this study provided a design that addresses the identified research problem and how the study results can address the water quality and conflict for effective decision making. The methodology adopted describes the research design, sampling procedure, data collection approach used and data analysis. The detailed methodology will be in the main findings.

Section 3.1, addresses the study area. Section 3.2, the conceptual framework. Section 3.3, study design, sampling and data analysis and finally Section 3.4 addresses the chapter summary.

3.1   STUDY AREA

The study was carried out in Wanjohi, Upper Turasha and Kianjogu catchments in the LNB. The study purposively selected the catchment areas identified for the PES scheme based on the biophysical features and established WRUAs. PES activities commenced with a feasibility assessment which determined whether there is a viable "business case" for the proposed PES initiative from the perspective of the potential buyers (users of water from the LN), and the potential sellers (providers of the ecosystem services from the upper catchment). Hence its choice as a study site.

3.1.1 Research design

This study utilizes mixed methods research design based on (Kumar 2014) classification research types (Pure or applied research; Descriptive, correlational, explanatory or exploratory research; Quantitative or qualitative). While it is an applied research under "application" classification, it exhibits all the aspects under the "objectives" classification i.e. it attempts to describe systematically the situation in the Lake Naivasha Basin, seeks to establish existence of relationship between two or more aspects of a situation and attempts to clarify why or how the relationships exist.

Wanjohi sub-catchment is one of the smaller areas that form Malewa, which constitutes the upper Lake Naivasha catchment.
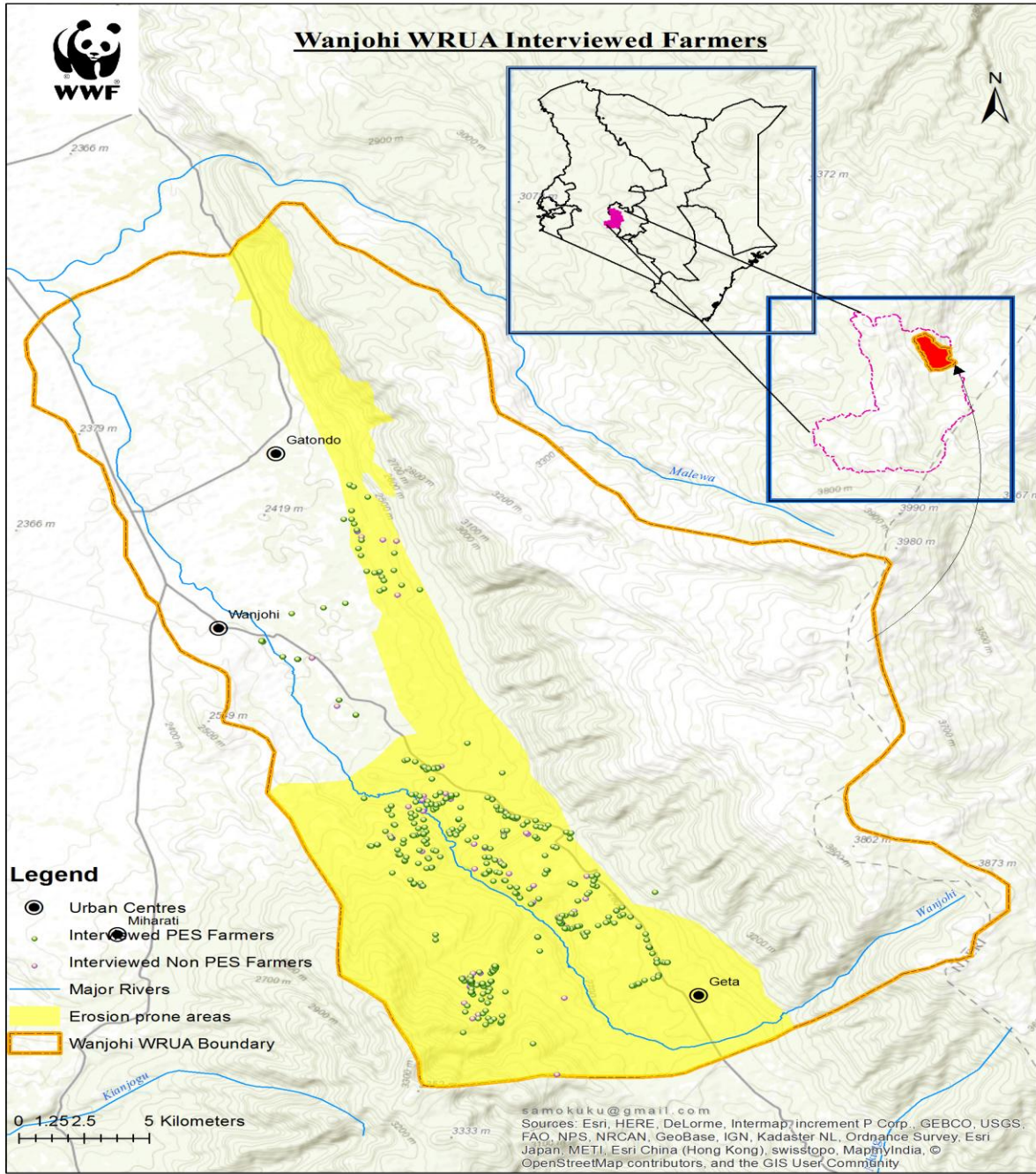
Figure 1: Wanjohi Catchment area

Upper Turasha Kinja is one of upper catchments of the Lake Naivasha basin. The sub catchment borders the Aberdare National Park on the East, Mukungi/Kitiri WRUA to the north, Tana catchment and Lower Malewa to the south east and west respectively. There are two major tributaries in the sub catchment i.e. Turasha and Kinja which mainly drain other small streams and springs originating from the Aberdares. It has an average annual rainfall of 1500mm and an average altitude of 2600m a.s.l. (sub-catchment management plan version 1).
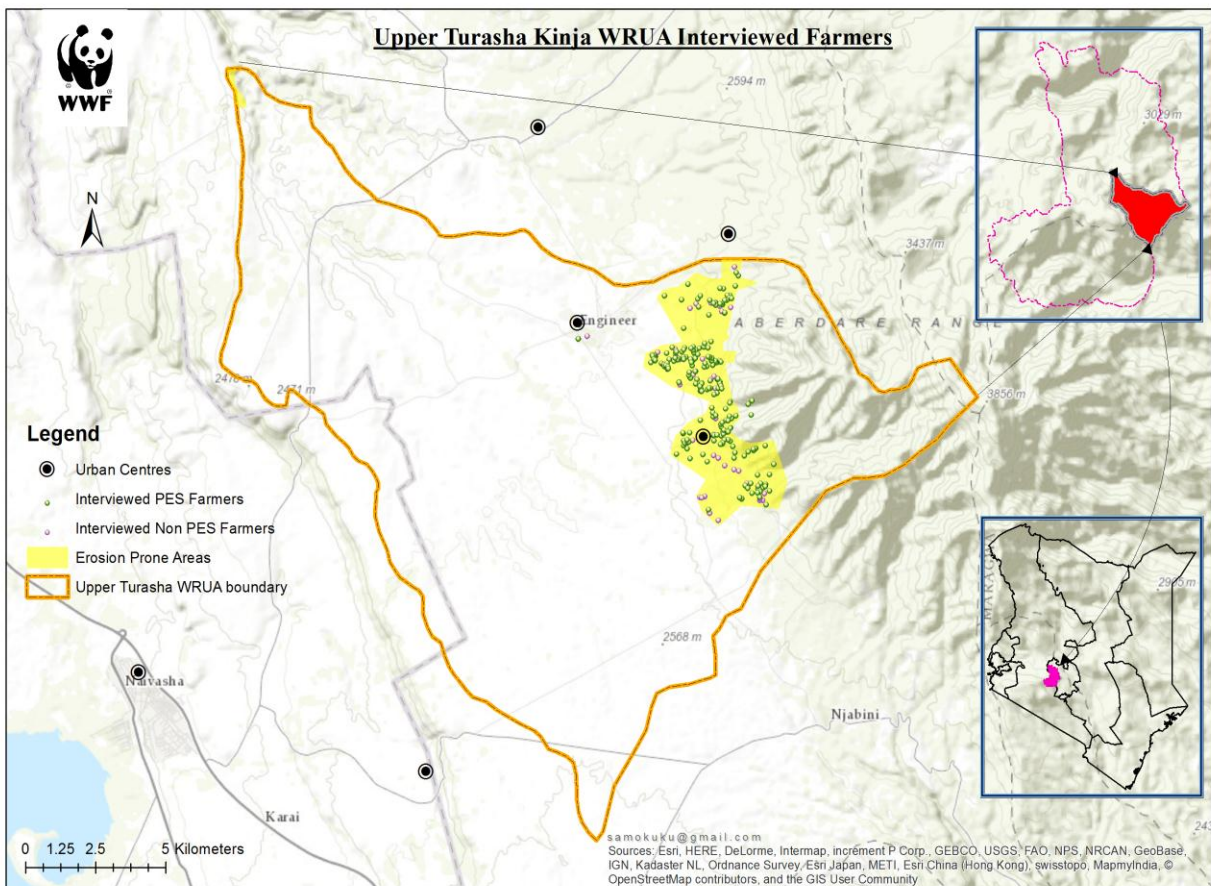
Figure 2: Upper Turasha WRUA
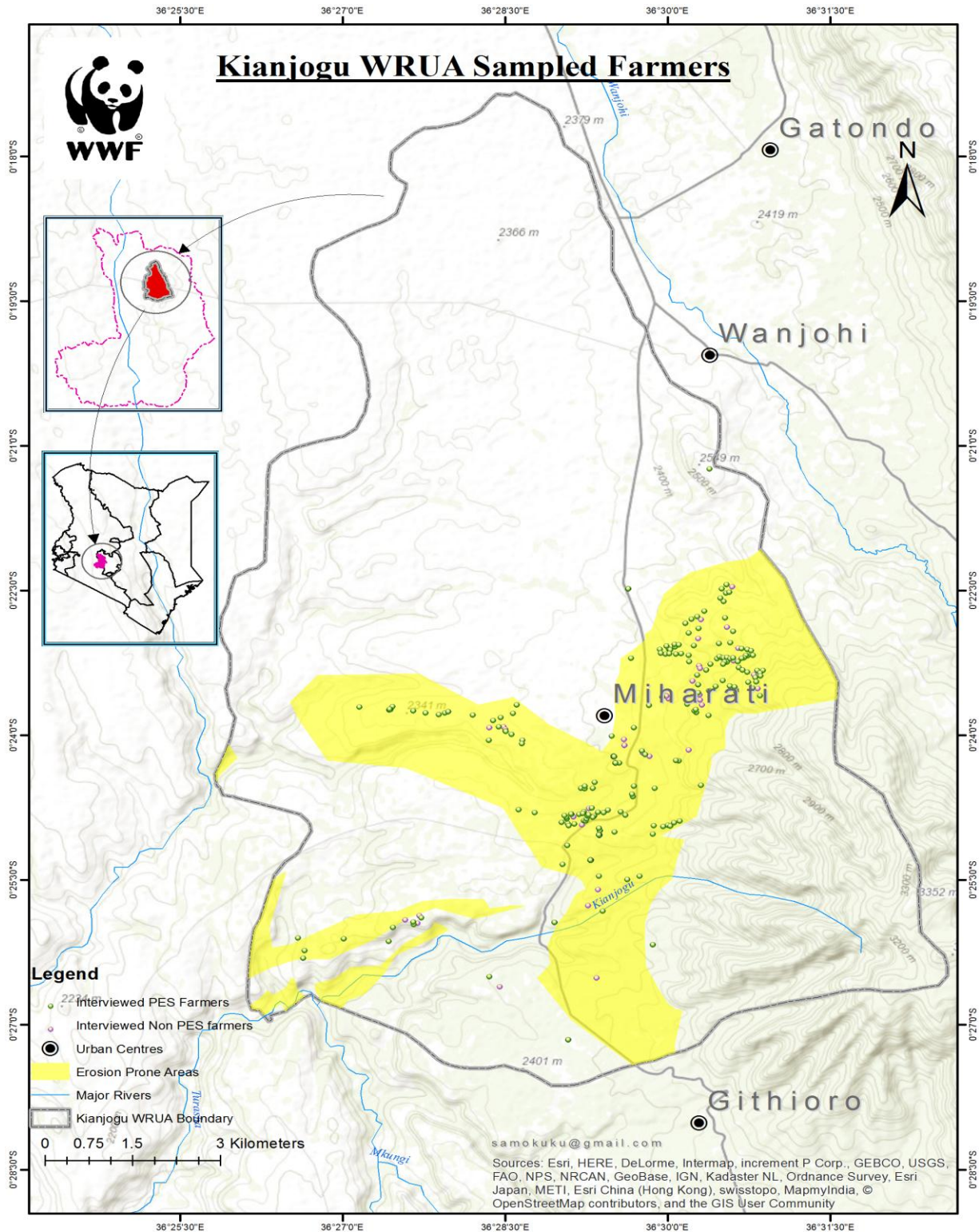
Figure 4: Kianjogu WRUA

3.1.2   Regression analysis

The statistical software used was SPSS. Regression analysis was chosen to analyse several variables. Independent variables: land ownership document type; knowledge of water regulations; knowledge of Protected Areas; the impact of extension officers; knowledge of negotiation process; committee importance; the cost of agricultural inputs where the relationship includes Dependent variables: water quality after PES and conflict experienced. The regression analysis was used to test the nature of relationships between the dependent variables and the independent variables.

For Chapter 4 and 6, the following regression was conducted with the dependent variable as water quality after PES. At the Multivariate level, a multinomial logistic regression analysis was employed because the dependent variable "Water quality" had more than two levels. The dependent variable for "water quality after PES" was measured as "Very poor", "Poor", "Average", "Good" and "Very Good", however, some observations in some categories were too small and as such some categories had to be collapsed so as to reduce the effects of having large odd ratios. As such a nominal variable with three categories was created; Poor, Average and Good which was used as the category under the dependent variable.

3.2 CONCEPTUAL FRAMEWORK
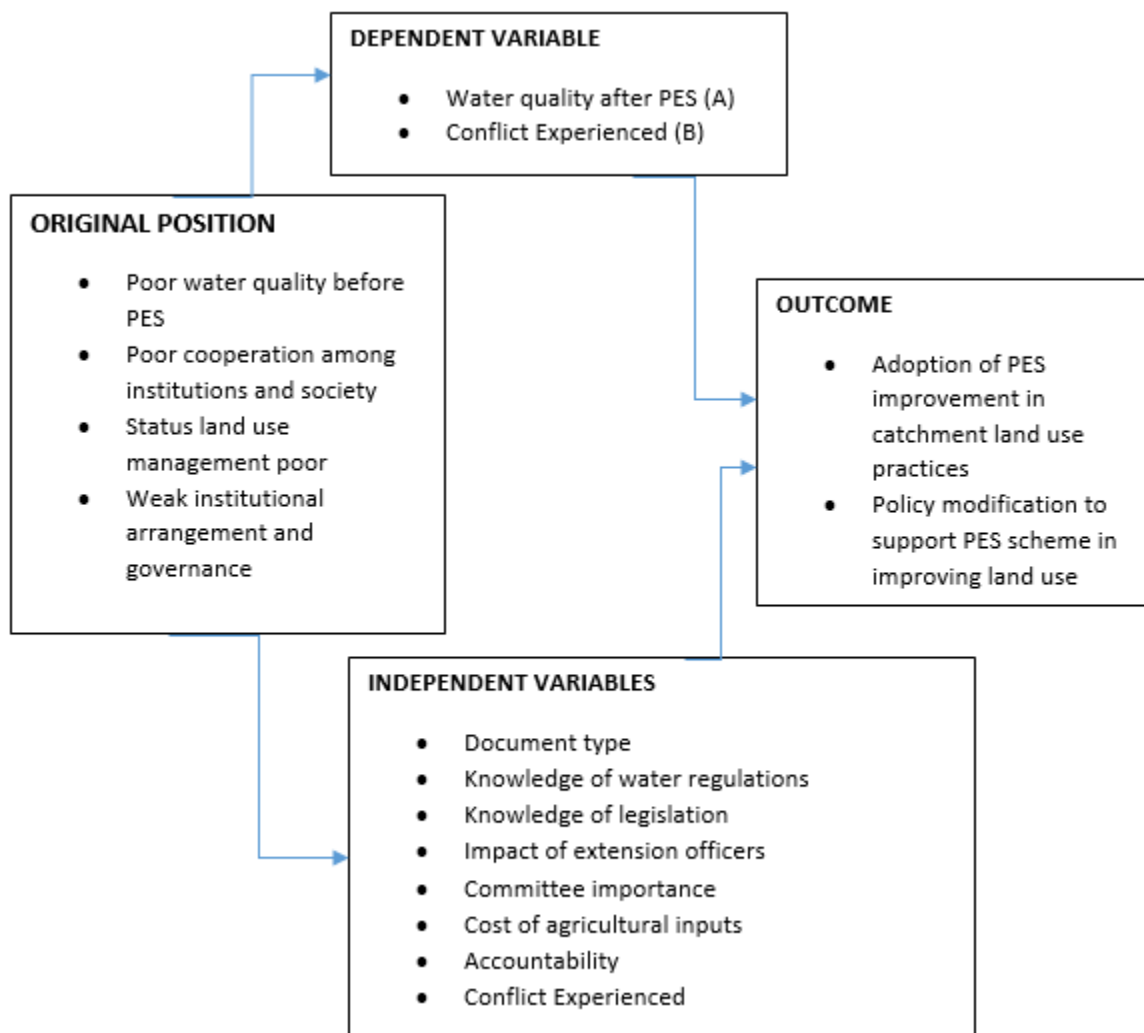
Figure 5: Conceptual Framework

Source: Author

This study in assessing the status of land use management and PES governance regarding regulation (law, policy, and institution), examined how the independent variables (see conceptual framework) regressed against the dependent variable (marked as dependent variable "A" in the conceptual framework above). Dependent variables "A" and "B" are not substituted in

addressing the independent variables but addresses each context based on the research questions. These variables provide an institutional framework guiding the biophysical characteristics and regulation, while legislation and regulations overcome the adaptive limits of the variables indicated. Our analysis of governance in a PES demonstrates that previous regulation and legislation bolsters policy adaptability, which in turn nurtures current governance practices within committees and institutions. We find that water quality after PES and governance drive PES effectiveness both independently and interactively. When water quality after PES is enhanced, governance and institutional structures contribute more to effectiveness.

This study is assessing the current status of cooperation between institutions and society, examined how the impact of the extension officers, cost of agricultural input is associated with experiencing conflict (marked as dependent variable "B" in the conceptual framework above). We argue that experiencing conflict and cooperation are not substitutes but complements about PES effectiveness. Knowledge of water regulation, legislation and negotiation process/contract provides an institutional framework guiding the course of cooperation, while cooperation overcomes the adaptive limits of knowledge of water regulation, legislation and negotiation process/contract contracts. Our analysis of cooperation in a dynamic market demonstrates that previous cooperation bolsters contractual adaptability, which in turn nurtures current cooperation between the same partners. We find that contract completeness and cooperation drive PES effectiveness both independently and interactively. When contracts are complete, cooperation contributes more to PES effectiveness. Contract and cooperation differ in their quadratic effects such that the contribution of contract completeness to performance declines as completeness increases but the contribution of cooperation remains linear.

3.3   STUDY DESIGN, SAMPLING AND DATA ANALYSIS

Methodology in a restricted narrow sense is "methods" of data collection, analysis and interpretation. However, it should be necessary to set up this study in its wider context. From an epistemological point of view, a quantitative researcher is independent of what is researched, and for the qualitative researcher, there is interaction with the participants. Quantitative is objective and qualitative is subjective (Hussey and Hussey 1997).

The study used both quantitative and qualitative methods. The major components of a good quantitative purpose statement include the identification of theory, model or conceptual framework to test in the study (Creswell 2003).

The quantitative methods are framed in the form of a questionnaire addressing issues of both biophysical and socio-economic. Issues of institutional concerns are also addressed. The qualitative method was used to strengthen certain answers as addressed in the quantitative approach. Finally, the game theory with the sub-component the snowdrift theory translates the level of cooperation among the farmers and or institutions as positive or negative cooperation. Two variables are considered important in the study of natural resource management within the LNB but fall outside of the design principles – Policy for enhancing PES practices.

3.3.1   Data Sampling

A representative sample of 1516 respondents is drawn from LNB. Out of these, 1378 respondents filled and returned the questionnaires making a response rate of 89.3%.

The select target population, the upper catchments and lower catchments within the LNB are stratified into three catchment areas and a proportionate sampling procedure employed to ensure

that the numbers of samples drawn were relative to the size of each stratum. Purposive sampling was applied to PES farmers between the periods of January 2016 to May 2016.
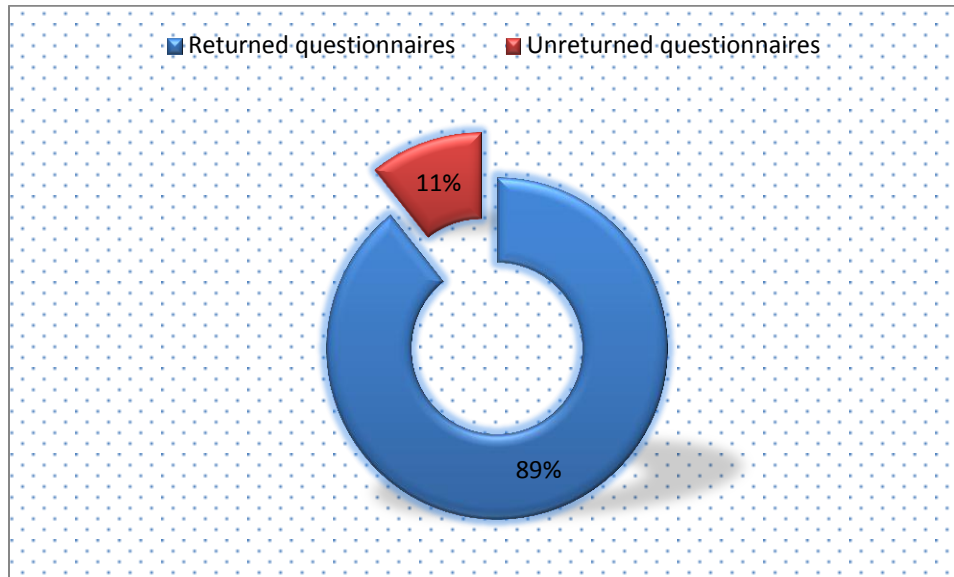
Figure 6: Response Rate

The PES and non–PES farmers at the upper catchments were interviewed, concerning water quality in Naivasha, Kenya. Questions asked relates to the objectives of the study as stated in 1.2. The questionnaire has six sections: A, B, C, D, E, and F. see annex 1 for details.

- Section "A," is about general information;
- Section "B," is on farm income;
- Section "C," is on access to credit;
- Section "D," is on knowledge of environmental legislation;
- Section "E," is for the benefit of PES; and
- Section "F" is on governance;

3.3.2 Data Analysis

The difficulty in the use of qualitative data is reflected by the methods of analysis whereas for quantitative data; there are clear conventions that the researcher can use. Other secondary internal sources of information, which were gathered included, journals and published surveys. Qualitative data collection types included observation, that is first-hand experience by the researcher; here information is recorded as received.

The supervisor verified the information on thesis study.

3.4 CHAPTER SUMMARY

PES schemes are seen to reward land users who adopt practices that generate environmental services. The three catchment areas were selected for this study and questionnaires developed to solicit questions on the three objectives stated in chapter 1.

The reasons for choosing regression analysis and the dependent and independent variables were stated. Finally, the research design employed also discussed. 89% of the questionnaires given out were filled, given the study, the relevance needed to analyze the data.

4 PAYMENT FOR ECOSYSTEM SERVICES IN MANAGING LAND USE

This chapter presents the results of data collected and analyzed following the methodology outlined in Chapter 3, to address research question one. To assess the status of land use management, the previous chapter, established that regression analysis is useful in studying factors that influence decision making in water management. Discussions are done in line with the objectives 1, of this study. Section 4.1 presents the introduction of the study, while section 4.2 presents the materials and methods. Section 4.2.1 presents the study area, section 4.2.2 the data needed for regression, section 4.2.3 the study design sampling and data collection, section 4.2.4, the data analysis. Section 4.3 addresses results and discussion, section 4.3.1, basic socio-economic attributes of land use, section 4.3.2 discussion on clearly defined boundaries. Section 4.4 presents the chapter conclusion.

4.1 INTRODUCTION

To enhance the environmental sustainability of natural resources, altering land use has been considered as one of the viable options. Alternative land-use change that conserved the natural resources is best for regulating ecosystem services (Reyers *et al.* 2012). Managing landscapes requires the development of effective partnerships (Brinson and Eckles 2011). 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 (Silva and Khatiwada 2014). Unless the value of the ecosystem (Protected Areas) is known to the local communities, it is difficult for policymakers to consider alternative land use policies. Several challenges impeding the implementation of conservation programs in Africa has been highlighted (Mbow *et al.*, 2014).

Agroforestry is one of the few land use strategies that promise synergies between food security and climate change mitigation and is less likely than other strategies to negatively affect water cycle regulation or biodiversity conservation (Mbow *et al*., 2014). There is the need to consciously promote land-use practices (Sanchez-Azofeifa *et al.* 2005).

A study conducted by (Raudsepp-Hearne *et al.* 2010) on agricultural landscapes in Montreal, Canada, discussed conflict arising from land-use activities. This is the case of Naivasha with the development of the contract between the WRUA and LANAWRUA on the roles of the buyers and suppliers of ecosystem services. In countries like Indonesia and Malaysia, land-use planning power often resides at the provincial/state level. Thus, negotiations between these authorities are critical in determining whether conservation project succeeds (Fisher *et al*. 2011). Individuals whose land-use decisions differ from the majority in the community may be exposed to social pressures, however, investment in PES is the best way to conserve the environment (Chen *et al.,* 2009).

Past studies have focused policies on land use and PES participation when the PES program ends (Chen *et al*., 2009). The lack of or inadequate policy to prevent environmental damage led to rapid decreases in vegetation cover and a serious increase in soil erosion (Cao 2009). There is need to develop compensation strategies for farmers to adopt sustainable farming practices. Conservation policies have been deployed to financially compensate countries that improve forest conservation and management to mitigate climate change (Phelps *et al*. 2013).

Leaders across the public, private, and non-profit sectors are mobilizing to incorporate the values of natural capital into land-use and policy decisions by creating broader institutional and cultural changes (Daily *et al*. 2009). Improved landscapes have more benefits for land user (Raudsepp-Hearne *et al*. 2010). Thus clearly defined property rights and access to resource use are crucial to establishing conservation programs. However, giving local managers property rights over their ecosystem may not be sufficient to protect that ecosystem, as they may be forced by the necessity to survive to adopt unsustainable alternative land uses with immediate perceived benefits (Cao 2009).

Land use is a serious issue in Kenya, especially in the ASALs. About 30 % of Kenya's landmass is subject to severe land degradation (Mulinge 2016).

Water Act 2016, section 10 (1) requires the formulation of a National Water Resource Strategy to provide measures for the protection, conservation, control, and management of water resources and approved land use for the riparian area. PES schemes could prevent water contamination as well as improve water quality (Muniz and Maria Joao Cruz 2015). The PES scheme involves land use transformations by the upstream farmers to provide downstream users with quality water as environmental services.

Several studies have reported on land degradation in Kenya as a result of increased sedimentation of water bodies from soil erosion (Mulinge *et al.,* 2016), thus resulting in poor water quality. Some studies have examined the growing public concern about the deterioration of water quality and highlighted the positive initiatives such as government's response by developing regulations to ensure impacts on water quality, with a commitment to ensuring public input (Clamen and Macfarlane 2015).

There was a need to study and explain the contribution of land use management to improved water quality in Kenya. In Naivasha, Kenya, the upstream farmers are to ensure the monitoring, coordination and implementing of conservation measures, receive payment, compile and submit a financial report. The downstream water users are to mobilize funds, submit digital turbidity data to and acquire appropriate rainfall data from WRA, participate in the quarterly monitoring of the programme, compile a programme financial report, compile annual programme progress reports and collect stories of change from participating land-owners to update the negotiation package.

This chapter contributed to the existing literature on water quality by examining the significant relationship between property rights, knowledge of protected areas, and knowledge of water regulation and negotiation process. The research is important because many farming communities, especially in Kenya, Naivasha, generally are highly differentiated and stratified regarding land uses. In such circumstances, the question of clearly defined boundaries becomes especially important because the land ownership documentation associated with the land use is seen to improve the implementation of PES schemes. In the following, the key results are discussed and conclusions provided.

4.2   MATERIALS AND METHODS

4.2.1   Study Area

The study was carried out in the upper catchments of the Lake Naivasha Basin (LNB). The specific details on the research site and study area are set out in Section 3.1 of this thesis.

4.2.2   Study Design, Sampling And Data Collection

The study used both quantitative and qualitative methods. 1143 PES farmers and 235 non-PES farmers. 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. A total of 1378 respondents were finally interviewed under objective one of the study. 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). he 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.

4.2.3   Data analysis

At the Multivariate level, a multinomial logistic regression analysis was employed because the dependent variable "Perceived water quality" had more than two levels that are (poor; average; good). The regression model was used to determine the relationship between the independent variables (land ownership document type, negotiation process, water regulation and legislation of protected areas) and the dependent (water quality).

4.3 RESULTS AND DISCUSSION ON THE STATUS OF LAND USE

4.3.1 Results: Basic Socio-Economic Attributes for Land Use Management

Regression analysis was chosen to analyse the independent variables: land ownership document type; knowledge of water regulations; knowledge of Protected Areas; and knowledge of negotiation process. Dependent variable was perceived water quality after PES.

Table 3: Regression on land use

Variables	Average			Good		
	B	**P-Value**	**OR [95 % CI]**	**B**	**P-Value**	**OR [95 % CI]**
Constant	-1.69	.038		-0.50	.454	
Land ownership document type						
Title deed	2.24	.006	9.43 [1.93 , 46.07]	1.12	.089	3.07 [0.84 , 11.16]
Allotment letter	3.30	.003	27.08 [3.1 , 236.68]	0.39	.721	1.48 [0.17 , 12.72]
Sufficient authority (RC)			1			1
Legislation Protected Area						
No	1.96	<0.001	7.13 [2.73 , 18.62]	2.23	<0.001	9.29 [3.59 , 24.03]
Yes (RC)			1			1
Water Regulation						
High	1.12	.013	3.07 [1.27 , 7.4]	0.62	.169	1.87 [0.77 , 4.55]
Medium	1.59	<0.001	4.92 [2.75 , 8.8]	1.27	<0.001	3.57 [2. , 6.38]
Low (RC)			1			1
Process Negotiations						
Strong knowledge	1.41	.002	4.11 [1.7 , 9.91]	0.91	.047	2.48 [1.01 , 6.08]
Fair knowledge	0.17	.577	1.19 [0.65 , 2.19]	0.66	.033	1.93 [1.05 , 3.53]
Neutral (RC)			1			1

Source :	
Nagelkerke R-Square	0.14
Reference Category	RC
Reference Category is Poor	
Odds Ratio	OR

There was a significant association between land ownership document type and water quality. Farmers with title deed were 9.43 times as likely to rate water quality as average then poor as compared with farmers with sufficient authority.

There was a significant association between knowledge of protected areas and water quality. Farmers who do not have knowledge of protected areas were 7.13 times and 9.29 times as likely to rate the water quality after PES as average and good respectively than poor when compared with farmers who have knowledge of protected areas.

Concerning water regulation, farmers with high water regulation were 3.1 times as likely to rate the water quality as average than poor. Farmers with medium knowledge of water regulation were 4.92 times as likely to rate water quality as average than poor as compared to farmers with Low water regulation. Similarly, these farmers were 3.57 times as likely to rate the water quality as good than poor when compared with farmers with low knowledge of water regulation. There was no significant association between water quality and high knowledge of water regulation.

There was a significant association between strong knowledge of negotiation process and water quality. Farmers with strong knowledge were 4.11 times and 2.48 times as likely to rate water quality as average and good respectively than poor. There was also a significant association between farmers with a fair knowledge of negotiation process and water quality. These farmers were 1.93 times as likely to rate the water quality as good than poor using farmers with no knowledge of the negotiation process. As the number of farmers with no knowledge of negotiation process increase, the likelihood of water quality increases.

Land Ownership Document Type

Table 4: Land ownership Document Type

Land Ownership Document Type		
	N	Percent
Title deed	1322	95.9
Allotment letter	32	2.3
Sufficient authority(land, lease or other agreement)	24	1.7
Total	1378	100.0

The majority (1322, 95.9%) of the respondents had title deeds.

Table 5: Land Tenure

Land tenure		
	N	Percent
Private Ownership	1233	90.3
Communal land	15	1.1
Government trust land	119	8.6
Total	1378	100.0

The majority (1233, 90.3%) of the respondents indicated that their land was privately owned. (119, 8.6%) of the respondents indicated that they had government trust land while (15, 1.1%) of the total respondents was communal land. The study thus concluded that the tenure system was of household who privately owned the land.

Table 6: Scale of Farming Practices

The scale of farming practice		Frequency	Percent
Valid	Small-scale(land or other 5 acres)	1244	90.3
	Medium scale(5 to 12.5)	120	8.7
	large scale (more than 12.5)	14	1.0
	Total	1378	100.0

The study also sought to establish the scale of farming in the lake basin in Naivasha. Majority of the respondents (1244, 90.3%) indicated that they were small-scale farmers or their land was less than 5 acres. (120, 8.7%) of the respondents indicated medium scale farming. The least response (14, 1.0%) indicated large-scale farmers.

Table 7: Farm Size

	N	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**
Farm Size	**1315**	**3.35**	**3.153**	**1**	**35**

The mean size of the farm is 3.35 acres, where the minimum farm size is 1 acre, and maximum farm size is 35 acres. The standard deviation is 3.153.

Knowledge of the protected area

Table 8: Knowledge of Protected Areas

knowledge of the protected area		
	N	Percent
No	250	18.1
Yes	1128	81.9
Total	1378	100.0

Majority of the farmers had knowledge of protected areas (1128, 81.9%). FGD and key informants revealed that farmers had no time to spare for PES activities, e.g., attending the meeting, workshops, training and visiting extension service officials. They were working most of the time and were less likely to be exposed to new opportunities.

Knowledge of water regulation

Table 9: Knowledge of Water Regulation

Knowledge of Water regulation		
	N	Percent
High	178	12.9
Medium	694	50.4
Low	506	36.7
Total	1378	100.0

Majority of the farmers (694, 50.4%) had knowledge of water regulations.

Water Quality

Table 10: Water Quality after PES

Water Quality After		
	N	Percent
Poor	117	8.5
Average	642	46.6
Good	619	44.9
Total	1378	100.0

Majority of the respondents (46.6%) indicated that the water quality after PES was average.

44.9% of the respondents indicated that the water quality was good with 8.5% of the respondents

indicating that the water quality was poor.

Process Negotiations

Table 11: Knowledge of Negotiation Process

Process Negotiations		
	N	Percent
Strong knowledge	238	20.8
Fair knowledge	375	32.8
No	530	46.4
Total	1143	100.0

There was a general poor knowledge of negotiation process.

4.3.2 Discussions: Clearly Defined Boundaries

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 (Clement *et al.* 2010).

The majority of the respondents had title deeds. This is as a result of the capacity building by WWF and other agencies in instituting systems for land ownership. 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 (Clement *et al*. 2010). However, according to (Clement *et al*. 2010), 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.

There was a significant association between knowledge of protected areas and water quality. Hence, as the number of farmers with knowledge of protected areas increases, the likelihood of water quality will increase. FGD and key informants revealed that farmers had no time to spare

for PES activities, e.g., attending the meeting, workshops, training and visiting extension service officials. They were working most of the time and were less likely to be exposed to new opportunities.

Concerning water regulation, farmers with medium knowledge of water regulation were 3.65 times a likely to rate water quality as average than poor as compared to farmers with low water regulation. Hence, as the number of farmers with medium knowledge of water regulation increases, the likelihood of water quality increases.

There was an association between farmers with a fair knowledge of negotiation process and water quality. Hence, as the number of farmers with no knowledge of negotiation process increase, the likelihood of the perception of water quality decreases. This has led to a number of capacity building and awareness creation by WWF, Imarisha Naivasha and other support agencies and foreign universities to support the implementation of PES to achieve positive land use management.

4.4   CHAPTER CONCLUSION

This paper addressed the research question one (1) above. In particular, it focused on land ownership documentation type. The number of variables accounted for made up only 14% of the issues affecting water quality after PES; there is the need for further studies to identify other factors.

This thesis showed that majority of the respondents were small-scale farmers, with land size less than 5 acres. The mean size of the farm is 3.35 acres, where the minimum farm size is 1 acre, and maximum farm size is 35 acres. There was a significant association between land ownership document type and water quality. This implied that farmers who are renting land maximize on

the return, whereas farmers who relied mostly on sufficient authority or have title deeds are more likely to have decided to participate in sustainable land use management.

The thesis showed that majority of the farmers have title deeds. This is attributed to the significant knowledge of protected areas and water quality. Therefore, as the number of farmers with knowledge of protected areas increases, the likelihood of water quality will increase. As the number of farmers with medium knowledge of water regulation increases, the likelihood of water quality increases. As the number of farmers with knowledge of negotiation process increase, the likelihood of water quality increases.

5 ASSESSING THE LEVEL OF COOPERATION BETWEEN STAKEHOLDERS

This chapter presents the results of data collected and analyzed following the methodology outlined in Chapter 3, to address research question two. To assess the level of cooperation, the previous chapter established that the land use management is geared towards improving land use practices. Discussions are done in line with the objectives 2, of this study. Section 5.1 presents the introduction, while Section 5.2 presents the materials and methods. Section 5.2.1 addresses study design sampling and data collection, Section 5.2.2 presents the data analysis, Section 5.3 presents the results and discussion, Section 5.3.1 presents the basic attributes – benefits. Section 5.3.2, discussions on congruence. Section 5.4, the chapter conclusion.

5.1 INTRODUCTION

The promotion of conservation materials to trigger good agricultural practices is to address sustainable development. Sustainable development is increasingly being presented as a pathway to avoid irreversible damages to natural capital (Frazzoli *et al.*, 2009; Holden *et al*., 2014). 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 problem is how behavior that is costly to the actors but benefits other individuals can be maintained? The role of local authorities is critical in addressing this question. 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 (Ostrom 2010).

Cooperation in natural resource management is key; there have been some studies conducted, for example (Komakech and van der Zaag 2011), 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 (Harper *et al.,* 2011). Cooperation and emphasis on social as well as economic policies improve not only well-being, but also enhance many forms of public good (Butler and Oluoch-Kosura 2006). One example is the PES scheme in the LNB. 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 (Oribu *et al*. 2014). Planting of trees to protect the riparian land has been successfully adopted by the community (Nyongesa 2011).

The study has shown that the majority of farmers are influenced to make PES practice choices. However, the variation in farmers' preference for PES practices is influenced by the socioeconomic attributes for specific PES interventions (Nyongesa 2017). Lack of knowledge on existing conservation activities has been mentioned in a study conducted by (Harper *et al*. 2011). The adopted practices restore farm productivity and improve production of other ecosystem services including water flow to support commercial investment downstream (Nyongesa 2017). 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 (Mulatu *et al.* 2015).

Farmers make informed choices for PES farm practices with positive attributes on agro-ecosystems restoration and socio-economic needs as incentives for practice adoption (Nyongesa 2017).

Most of the studies on opportunity cost and benefit of the PES scheme argued that the opportunity cost of land guarantee more efficiency in the implementation of the PES (Young *et al*. 2014). This paper examined the cooperation between local authorities and PES and non-PES farmers in the case of the LNB in Kenya.

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 (Morinville and Harris 2014), and livelihood benefits (Grazhdani 2014).

This study illustrated the cooperation between local authorities and PES and non-PES farmers based on the opportunity cost and benefits for upstream landowners to ensure sustainable land use practices in Naivasha. It did so by examining adopted PES practices, benefits of the environment, knowledge of process negotiation, knowledge of protected areas, cost of agricultural inputs, knowledge of water regulation and impact of extension services. In the following, the results and conclusion are presented.

5.2   MATERIALS AND METHODS

5.2.1   Study area

The study was carried out in the upper catchments of the Lake Naivasha Basin (LNB). The specific details on the research site and study area are set out in Section 3.1 of this thesis.

5.2.2   Study design sampling and data collection

Local institution (WRUA and WRA) are caught in conflict and trapped on either sideof 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.

As for the Prisoner's Dilemma, the payoff values can be again conveniently rescaled such that $R = 1$, $P = 0$, $T = 1 + r$ and $S = 1 - r$ where r denotes a slightly different cost-to-benefit ratio $r = c / (2b-c)$. This parametrization results in a single parameter and preserves the proper payoff ranking required for the Snowdrift game

5.2.3   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.

5.3   RESULTS AND DISCUSSION

5.3.1   Results: Basic attributes: Benefits

In checking cooperation through regression, the objective 2, chapter 5, the study used a binomial logistic regression model, because the outcome variable was measured as a dichotomous (Yes/No). Regression analysis was chosen to analyse 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.

Table 12: Regression on cooperation

	B	P Value	OR [C I]
Constant	-2.022	<0.001	0.13
Process Negotiation			
Strong Knowledge (RC)			1
Fair	-.774	<0.001	0.46 [0.31 , 0.7]
Neutral Knowledge	-1.187	<0.001	0.31 [0.2 , 0.46]
Knowledge Protected Area			
No (RC)			1
Yes	.919	<0.001	2.51 [1.7 , 3.7]
Cost Agricultural Inputs			
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]
Water Regulation			
High (RC)			1
Medium	-.233	.341	0.79 [0.49 , 1.28]
Low	-.462	.087	0.63 [0.37 , 1.07]
Extension Impact			
High (RC)			1
Medium	2.586	<0.001	13.28 [5.43 , 32.45]
Low	1.164	.009	3.2 [1.34 , 7.67]
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 (Experience conflict).

There was a significant association between experience conflict 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 (530, 46.4%) 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.

With No Knowledge of protected areas as the reference point, farmers who stated they know 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.

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.

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.

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.

Knowledge of negotiation process

Table 13: Knowledge of Negotiation Process

Knowledge of Process Negotiations		
	N	Percent
Strong knowledge	238	20.8
Fair knowledge	375	32.8
No	530	46.4
Total	1143	100.0

There was a general poor knowledge of negotiation process.

Conflict experienced

Table 14: Conflict Experienced

Experience conflicts		
	N	Percent
No	530	38.6
Yes	844	61.4
Total	1374	100.0

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.

Table 15: 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	100.0

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 16: Adopted PES Practices

Adopted PES Practices	Frequency	Percent
No	63	26.8
Yes	172	73.2
Total	235	100.0

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 17 Knowledge of Protected Areas

knowledge of the protected area		
	N	Percent
No	250	18.1
Yes	1128	81.9
Total	1378	100.0

Majority of the farmers had knowledge of protected areas (1128, 81.9%).

Table 18: Cost of Agricultural Inputs

Cost agricultural inputs		
	N	Percent
High	121	8.8
Medium	790	57.3
Low	467	33.9
Total	1378	100.0

Majority of the respondents stated a relatively higher cost for agricultural inputs.

Table 19: Knowledge of Water Regulation

Knowledge of Water Regulation		
	N	Percent
High	178	12.9
Medium	694	50.4
Low	506	36.7
Total	1378	100.0

Majority of the farmers (694, 50.4%) had knowledge of water regulations.

Table 20: Impact of Extension Officers

Impact Extension		
	N	Percent
High	52	3.8
Medium	500	36.3
Low	826	59.9
Total	1378	100.0

Farmers (826, 59.9%) complained about the low impact of extension services.

5.3.2   Discussions: Congruence

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.

There was a significant association between experience conflict and knowledge of negotiation process. Hence, as the number of farmers with no knowledge of negotiation process increases, the likelihood of experiencing conflicts increases. This arrangement is stipulated in the contract signed between the WRUA and LANAWRUA. However, there seems to be a high number of respondents who seem not to understand the negotiation process clearly and this could affect the cooperation between the buyers (LANAWRUA) and the sellers (WRUA). Therefore, there is a need for capacity building to train and explain the contract details for the farmers to understand.

As the number of farmers without knowledge of protected areas increases, the likelihood of water quality will decrease. Protected Areas (PAs) usually contain existing human settlements with unclear property rights, as is often observed in other countries (Clement, T., et al. 2010). 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.

In relation to conflict experienced and cost of agricultural inputs, as the cost of agricultural inputs decreases, the likelihood of experiencing conflicts reduces. As the knowledge of water regulation increases, the likelihood of experiencing conflicts reduces.

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. Therefore, as the impact of the extension services increases, the likelihood of experiencing conflicts reduces.

5.4   CHAPTER CONCLUSION

This chapter, discussed the adopted PES practices, benefits of the environment, knowledge of process negotiation, knowledge of protected areas, knowledge of water regulation, cost of agricultural inputs and impact of extension services relating to conflict experience. 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 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. This is through the introduction of cocksfoot and nippea grass as conservation instruments. Other stakeholders benefit as a result of an increase in water quality, hence reduced cost on maintenance especially about equipment's used for hotel operations (bathroom, kitchen).

Conflict experienced has a significant relationship with process negotiation, knowledge of protected areas, knowledge of water regulation, the impact of extension services and cost of agricultural inputs. However, cooperation between these agencies and with support from WWF and the coordination of Imarisha Naivasha, a series of capacity building activities has increased the understanding of resource management and also lead to a reduction in conflict.

6   THE GOVERNANCE OF PAYMENT FOR ECOSYSTEM SERVICES IN THE LAKE NAIVASHA BASIN

This chapter presents the results of data collected and analyzed following the methodology outlined in chapter 3, to address research question three. To assess the positive governance of the PES structure, the previous chapter, highlighted the following variables, cost of agricultural inputs and impact of extension services as influencing cooperation. Discussions are done in line with the objectives 3, of this study. Section 6.1 presents the Introduction, while Section 6.2 presents the Materials and Methods. Section 6.2.1, the Theoretical and Empirical approach, Section 6.2.2 presents Data Analysis. Section 6.3, the Results and Discussions. Section 6.3.1.1 discusses the results of the focus group. Section 6.3.1.2, discusses Emergence of the LNB committees. Section 6.3.2, discusses Principle 4 on community importance in monitoring. Section 6.4, the chapter conclusion.

6.1   INTRODUCTION

Command-and-control approaches are hampered by weak governance (Engel *et al.* 2008). The decentralization of natural resource management and recognizing the environment as one of the

key pillars of economic development is seen as a significant change regarding natural resource and environmental management (Fauzi and Anna 2013).

Governance arrangements need to include civil society and private sector as well as government. However, much attention in the natural resources management literature has focused on governance arrangements, specific to the resource sector at hand. A study by (Ratner *et al*., 2013) argues that considering broad governance characteristics such as state capacity and legitimacy, the rule of law and political organization is essential in conflict-sensitive environments. Institutions (sets of rules) and governance structures that make the governance characteristics effective emerge either spontaneously through self-organization or intentionally by human design.

The existing evidence base on governance instruments is weak in Sub-Saharan Africa (Schoneveld 2016). In Africa, there is an emerging literature on river committees from Tanzania (Komakech and van der Zaag 2011), the model of governance there is similar to that of Kenya, Naivasha, as it is based on the biophysical context and socio-economic context (setting up of river committees, committees' institutional structure, water allocation and enforcement). For successful implementation and governance of PES schemes, it is essential to understand the various dimensions of value that can be shared by different groups within society about the natural environment (Reed *et al*. 2017).

Studies of institutional arrangement of water governance face the same challenges as those confronting any natural resource governance more generally. Some studies have pointed to the

fact that good governance policies have failed. Institutional adaptation suggests that PES can lead to the creation of new institutions, or enhance existing ones (Wertz-Kanounnikoff *et al.,* 2011). In the context of Kenya, Naivasha, the following institutions have been involved in the PES scheme,

Institution	Role
Hotels	Promote tree planting activities
Imarisha Naivasha	Responsibility for Coordination. Establish an enabling environment in the basin for Networking, collaboration, conflict resolution and harmonization of various interests as well as linkages with the County and National governments as well as at global levels
WRA	Water Resources Authority (WRA) is a state corporation established under Section 11 of the Water Act, 2016. Under Section 6 of the Act, the Authority is an Agent of the National Government responsible for regulating the management and use of water resources. The Water Act, 2016 makes extensive provisions on the Authority's role in regulating the use and management of water resources.
LANAWRUA	Downstream stakeholders contribute to the upper catchment farmers
WWF	Facilitate the activities to promote PES
WRUA	Means on-farm soil and water conservation, rehabilitation, and management of riparian land, on-farm tree planting, rehabilitation of degraded sites, monitoring of silt loads in river water
Flower Farms	Promote tree planting activities
Others	Promote tree planting activities

Studies on the institutional arrangement of water governance have used a great variety of indicators such as accountability, information flow, trust and negotiation (Kovacs *et al*. 2016). Trust is considered one of the key components for policy reform and is important in governance for several reasons. According to (Cerna 2014), trust decreases the risk inherent to cooperative relations since it creates greater predictability.

Collaboration efforts have proven crucial in gaining public trust and building collaborative capacity. However, actions that create distrust make wetland management more politically difficult, even when legally appropriate (Downard *et al*. 2014). Stakeholder participation has been argued as a way to increase public trust in decisions and as an empowerment tool through the co-generation of knowledge (Lemoine and Patrick 2014). Key implications for effective natural resource management was highlighted by (Turner *et al*. 2016), which demonstrated the importance of trust as a prerequisite for legitimacy in a large, complex, social-ecological system. This study illustrated the implementation of positive governance of a PES scheme in Naivasha, Kenya. It did so by understanding the emergence and functioning of river basin committees within the Lake Naivasha Basin. In the following, the key results followed by discussions and conclusions.

6.2   MATERIALS AND METHODS

6.2.1   Study area

The study drew on the concept of institutional bricolage and Ostrom's design principles (Komakech and van der Zaag 2011). The underlying assumption of this concept was the adaptation of institutions for multiple purposes, and the need to foster cooperation (Komakech and van der Zaag 2011).

The study was carried out in the upper catchments of the Lake Naivasha Basin (LNB). The specific details on the research site and study area are set out in Section 3.1 of this thesis.

Payment for environmental service can take the form of local mechanisms where in the case of LNB, the Wanjohi, Upper Turasha and Kiambogu catchment areas get contributions from the LANAWRUAs to conserve their catchment areas. Here WRUA committees are formed to address the needs of the LANAWRUA and ensure the efficient usage of the funds and also ensure the implementation of the contracts signed between the LANAWRUAs and the PES farmers. The main challenge to operationalizing WRUA committees is lack of clear legislation and undervaluation of ecosystem resulting to low resource allocation. The main institutions that have spearheaded the formation of the WRUA committees are the World Wide Fund for Nature (WWF).

6.2.2   Theoretical and empirical approach

The study applied the Ostrom's design principles (Komakech and van der Zaag 2011). In the context of PES, the study was interested in the degree to which powers have been devolved to institutions that are accountable to water resource users, as these are typically based on the failure of central government to deliver (Kauzya 2007). In this concept, powers refer to authority to make rules and decisions regarding water management, as well as to implement, enforce and adjudicate said rules. In practice, this implied attention to the degree to which the WRUAs can decide about the availability of water for abstraction, the issuance of permits, including decisions that affect the benefits that water use give rise to. This way of assessing what powers have been conferred on the lower level institutional arrangement is in line with the Kenya, Water Act, 2016. For any new water institution to be effective, it must be consistent with both the government and

local-level institutions (Komakech and van der Zaag 2011). This, however, requires a good understanding of how local arrangements emerge, evolve and continue to function over time. Also, understanding the interface between locally developed water institutions and those created by the central government could add insight into the development of integrated catchment management institutions.

Accountability implies that the body receiving such powers can be held responsible, to answer for its actions, by members of the association living in the water catchment areas. Good governance is promoted through transparency, accountability and participation (Bennett and Dearden 2014). According to (Cerna 2014), trust is an ingredient in policymaking which concerns accountability mechanisms and capacity building. This goes to explain that trust is needed to be able to function effectively when dealing with water resource users.

The study reviewed the Water Act 2016 and WRUA management plans and agreements (contract) and did in-depth interviews with key informants. These included: 3 WRUA executives, 1 WRA official, 3 WWF officials, 2 Hoteliers, 1 Imarisha Naivasha official and 1378 farmers. The informants were purposely selected for their ability to inform the study objectives. The interviews were guided by interview guides specific for each main stakeholder group prepared in advance of the interviews. Where the interviewee gave consent, the interviews were recorded, else detailed notes were taken.

6.2.3 Data analysis

The qualitative information gathered through interviews and informal discussions was transcribed and used to support the quantitative data. Refer to 3.3.2 on data analysis under research methodology, chapter 3. The quantitative data from the survey was organized in SPSS from where descriptive statistics and regression analysis were prepared to analyze the governance arrangement employed by stakeholders with different institutional needs.

A Likert scale (strongly agree to strongly disagree) was used to obtain information on trust from the PES farmers, as it is assumed that this measure would likely shape the governance-related outcomes. Before the survey, a list of governance indicators was defined based on focus group discussions with the stakeholders. During the survey, respondents were asked about Knowledge of Protected Areas, Knowledge of Water regulation, Knowledge of Negotiation Process and Committee Importance.

The regression model was used to determine the relationship between the independent variables (Knowledge of Protected Areas, Knowledge of Water regulation, Knowledge of Negotiation Process and Committee Importance) and the dependent variable (perceived water quality after PES).

6.3 RESULTS AND DISCUSSION

6.3.1 Results: The emergence of LNB Committees

Regression analysis was chosen to analyse the independent variables: knowledge of water regulations; knowledge of Protected Areas; knowledge of negotiation process; and committee importance against the dependent variable, water quality. The regression analysis was used to test the nature of relationships between the dependent variables and the independent variables.

Table 21: Regression on committee

Variables	Average			Good		
	B	**P-Value**	**OR [95 % CI]**	**B**	**P-Value**	**OR [95 % CI]**
Constant	-0.06	.930		0.58	.391	
Legislation Protected Area						
No	2.21	<0.001	9.08 [3.41 , 24.17]	2.41	<0.001	11.15 [4.26 , 29.22]
Yes (RC)			1			1
Water Regulation						
High	0.87	.068	2.38 [0.94 , 6.02]	0.45	.339	1.57 [0.62 , 3.98]
Medium	1.29	<0.001	3.65 [1.95 , 6.82]	1.06	.001	2.88 [1.56 , 5.32]
Low (RC)			1			1
Process Negotiations						
Strong knowledge	0.45	.349	1.57 [0.61 , 4.05]	0.11	.813	1.12 [0.43 , 2.91]
Fair knowledge	-0.63	<0.001	0.53 [0.27 , 1.05]	-0.01	.985	0.99 [0.51 , 1.93]
Neutral (RC)			1			1
Committee Important						
Agree	2.42	.001	11.19 [2.61 , 47.93]	1.55	.026	4.72 [1.2 , 18.57]
Neutral	-0.52	<0.001	0.59 [0.14 , 2.47]	-0.76	<0.001	0.47 [0.12 , 1.77]
Disagree (RC)			1			1
Source :						
Nagelkerke R-Square	0.221					
Reference Category	RC					
Odds Ratio	OR					
Reference Category is Poor						

The model produced a Nagelkerke value of 22%. This implies the independent variables were explaining 22% of the variation in the dependent variable (Water quality after PES).

There was a significant association between Knowledge of Protected Area and Water quality after PES. Farmers who do not have knowledge of Protected Area were 9.08 times as likely to rate the water quality as Average than Poor as compared to farmers with knowledge of Protected Legislation Area. They were also 11.15 times as likely to rate the water quality as Good than Poor when compared with farmers in with knowledge of protected areas.

A farmer with Medium knowledge of water regulation was 3.65 times as likely to rate the water quality as Average than Poor as compared to farmers with low knowledge of water regulation. They were also 2.88 times as likely to rate the water Quality as Good than Poor. There was no significant association between High knowledge of water regulation and Water quality rating. Nevertheless, Farmers with high knowledge of water regulation were 2.38 times as likely to rate the water quality as Average than Poor as compared to farmers with Low knowledge of water regulation. They are also 1.57 times as likely to rate the water quality as Good than Poor.

Table 22: Importance of Committee

Importance of Committee		
	N	Percent
Agree	846	74.0
Neutral	270	23.6
Disagree	27	2.4
Total	1143	100.0

There was a strong significant association between Committee Importance and Water quality after PES. Majority of the farmers (846, 74%) agreed that committees are important.

Table 23: Water Quality after PES

Water Quality After		
	N	Percent
Poor	117	8.5
Average	642	46.6
Good	619	44.9
Total	1378	100.0

The majority (642, 46.6%) of the farmers indicated that the water quality after PES is average. The statement made by a KWS 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 in regulating water abstraction by the stakeholders (flower farmers, KenGen). Governance at the local level needs to be strengthened with streamlining the roles of each institution in addressing the water quality issue.

Table 24: Knowledge of Protected Areas

Knowledge of Protected Area		
	N	Percent
No	250	18.1
Yes	1128	81.9
Total	1378	100.0

Majority of the farmers (1128, 81.9%) had knowledge of protected areas.

Table 25: Knowledge of Water Regulation

Water regulation		
	N	Percent
High	178	12.9
Medium	694	50.4
Low	506	36.7
Total	1378	100.0

Majority of the farmers had a general idea of water regulation.

Table 26: Knowledge of Negotiation Process

Knowledge of Process Negotiations		
	N	Percent
Strong knowledge	238	20.8
Fair knowledge	375	32.8
No	530	46.4
Total	1143	100.0

Majority of the farmers don't have knowledge in negotiation process.

6.3.2 Discussion: on the role of committees in monitoring

This section discusses the committee formation and assesses the emergence of these institutions. From the literature review (section 6.1), rules, monitoring and enforcement at the local level (Engel *et al*., 2008), can be identified as contributory factors for the committee formed in the LNB catchments.

The committees benefited from the already existing arrangements such as WRA, WRUA and civil societies. The Water Act 2016 highlights the role of county government.

The statement made by a KWS 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 in regulating water abstraction by the stakeholders (flower farmers, KenGen). Governance at the local level needs to be strengthened with streamlining the roles of each institution in addressing the water quality issue. The cooperation among all stakeholders was based on how they support the committees through capacity building, support through the provision of tree seedlings and awareness creation at the community levels. Other support came from recruiting staff from communities as part of their drive to ensure increased livelihood.

There was a significant association between Knowledge of Protected Area and Water quality after PES. Farmers through the formation of committees ensured the resource for which they were protecting would guide the next generation. Most of these farms are family owned and used to support families, hence the need for the committees formed to identify illegal abstractors who are likely to default on the set agreement to protect the environment to ensure quality water.

In the negotiation process, the upper catchment farmers are to engage in sustainable farm practices to ensure water quality. This arrangement is stipulated in the contract. However, there seems to be a high number of the respondent who seems not to understand the process. This would then affect the monitoring of the farmer's activity and its related sanctions.

There was a strong significant association between Committee Importance and Water quality after PES. Hence, the higher the number of farmers who agree to the importance of committees, the higher the number of farmers who will rate the water quality as good as they will monitor water usage and any activities within the LNB to ensure compliance and adhering to the necessary Memorandum of Understanding (MoU) and rules.

6.4   CHAPTER CONCLUSION

This chapter discussed the importance of WRUA committees. Ostrom's design principles provided useful entry points in studying the functioning of the committees. One of the eight design principles was used to examine the governance of PES, which is, monitoring.

As the knowledge of protected areas increases, farmers can make informed decisions on management practices to ensure a more sustainable approach to resource management. Nevertheless, as the knowledge of water regulations increases, farmers can make informed decisions on management practices to ensure a more sustainable approach to resource management. As there seems to be a high number of respondents who do not understand the negotiation process clearly, this would then affect the monitoring of the farmer's activity and its related sanctions.

There was a strong significant association between Committee importance and perceived Water Quality after PES. Therefore, as the number of farmers who agree to the importance of committees, the higher the number of farmers who will rate the water quality as high as they will engage in proper monitoring and ensure adherence to proper practices. Given the lack of capacity of WRA to manage water resources, NGOs (WWF and GTZ) are helping build capacity to address the issue of governance through the devolved roles of the national government to the counties as stipulated in the Water Act 2016.

7 GAPS IN THE KENYA LAW AND POLICY FRAMEWORK ON PAYMENT FOR ECOSYSTEM SERVICES

7.1 INTRODUCTION

Policies to address environmental concerns has had both positive ecological and socio-economic outcomes and some negative consequences (Liu *et al*. 2008; Clamen and Macfarlane 2015). Kenya has gone through various water reforms to address the challenges facing the natural resources. The enactment of Water Act 2016 acknowledged the involvement of the local communities in state water management.

Weak institutions and lack of PES specific policies have made many policymakers acknowledge PES as an alternative actor to govern forests, pastures, water, and fisheries (Agrawal 2003). The need for equitable allocation of costs and benefits was highlighted (Scherr, Milder and Bracer 2006). This brings to bare the concept of PES, however, the lack of PES specific policies comes with some challenges. Policies need to establish rights to buy and sell ecosystem services and establish criteria needed for buyers, sellers and investors to engage.

Attempts at implementing PES in Africa has not reached the expected targets, both in reducing poverty and strengthening social justice, because of numerous pitfalls to effective policy design. Hence, there is the need to design policy and institutional arrangements around PES programs (Andrew and Masozera 2010). According to (Scherr, White and Khare 2004), different legal and regulatory frameworks are required for different types of payment schemes. Hence, the need for different policies when externalities are occurring together (Ezzine-de-Blas *et al*. 2016).

7.2 MATERIALS AND METHODS

7.2.1 Study area

The study was carried out in the upper catchments of the Lake Naivasha Basin (LNB). Refer to sub-chapter 3.1 on the study area.

7.2.2 Data analysis

Review of secondary data and policy briefs and also conclusions drawn from chapters 4 to 6, which has a suggested need for policy modification. Chapter 4, highlighted the difficulty in convincing policymakers to consider alternative land use policies. Especially where the values of the natural capital are not known. There is also the need for conservation policies to financially compensate members. The lack of policy has made environmental damage difficult to control. Chapter 5, highlighted the need for economic policy to promote the public good. There is also the need to integrate PES policy within the agricultural extension services. The need for a policy framework. Chapter 6, highlighted the need for good governance policies. Trust is a key policy reform tool.

Past studies have focused less on the impacts of subsequent policies on land use when a PES program ends (Chen *et al*., 2009). The lack of or inadequate policy to prevent environmental damage led to rapid decreases in vegetation cover and a serious increase in soil erosion (Cao 2009). Leaders across the public, private, and non-profit sectors are mobilizing to incorporate the values of natural capital into land-use and policy decisions by creating broader institutional and cultural changes (Daily *et al*. 2009).

7.3   RESULTS AND DISCUSSION

7.3.1   Results: Outcomes in Chapters 4-6 on Governance of PES in Kenya

The 1st objective which is Chapter 4 assessed the status of land use management of the LN catchment area and how it impacts on the water quality. A quantitative study conducted revealed that the majority (1322, 95.9%) of the respondents had title deeds. 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 (Silva and Khatiwada 2014). Unless the value of the ecosystem (Protected Areas) is known to the local communities, it is difficult for policymakers to consider alternative land use policies.

Agroforestry is one of the few land use strategies that promise synergies between food security and climate change mitigation and is less likely than other strategies to negatively affect water cycle regulation or biodiversity conservation (Mbow *et al*., 2014). There is the need to consciously promote land-use practices (Sanchez-Azofeifa *et al.* 2005). 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. 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 (Clement *et al*. 2010). However, according to

(Clement *et al*. 2010), 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 2nd objective which is Chapter 5 assessed the current status of cooperation between stakeholder. A quantitative study conducted revealed that the majority (844, 61.4%) of the respondents indicated that they had experienced conflict.

In relation to cooperation under the natural resource management plan, communities become the primary implementers, assisted and monitored by technical services such as the extension officers. As a bottom-top approach, the community based natural resource management attempts to assist local communities reduce poverty through sustained use of their natural resources (Chindo, M et al 2011). 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. The initiatives included the updated Water Act 2016 which provides for the inclusion and participation of the county government. However, community based natural resource management has witnessed a paradigm shift over the last two decades from the traditional command and control top-down approach that can lead to short-term economic returns. There have been earlier advocators for an alternative approach based on bottom-up direction by local communities in response to the top-down approach where they don't feel represented (Mumma, A., 2007; Chiramba, T. et al, 2011).

The 4th objective which is Chapter 6 analysed the governance context regarding regulation (law, policy, and institution) set up for good governance and implementation as informed by Kenyan law and policy.

A quantitative study conducted revealed that (846, 74%) of the respondents agreed to the importance of WRUA committee. a discussion with some of the key informant revealed that the lack of the committee created a leadership vacuum hence, rules and laws were not followed. The setting up of the committee has resulted in activities of the members been regularized and monitored especially for illegal abstraction.

In relation to governance of PES, the degree to which the WRA can decide about the availability of water for abstraction, the issuance of permits, including decisions that affect the benefits that water use give rise to assessing what powers have been conferred on the lower level institutional arrangement in line with the Kenya, Water Act, 2016. For any new water institution to be effective, it must be consistent with both the government and local-level institutions (Komakech and van der Zaag 2011). This, however, requires a good understanding of how local arrangements emerge, evolve and continue to function over time. Also, understanding the interface between locally developed water institutions such as the WRUAs and those created by the central government WRA could add insight into the development of integrated catchment management institutions.

7.3.2   Discussion: Policy gaps on the governance of PES in Kenya

Chapter 4: To assess the status of land use management of the LN catchment area and There was a significant association between land ownership document type and water quality. 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. Land ownership or resource tenure is clearly defined and protected by law (Clement *et al.* 2010). However, according to (Clement *et al.* 2010), 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. As the cost of agricultural inputs decreases, the likelihood of experiencing conflicts reduces.

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. On the issue of the level of

cooperation between stakeholders, it is recommended that 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.

In developing countries, especially Africa, attempts at implementing PES has not reached the expected targets, both in reducing poverty and strengthening social justice, because of numerous pitfalls to effective policy design. Vietnam is one of the first countries worldwide who applied a PES policy that regulates payments from tourism, where tourist service providers benefiting from forest environment services make a fixed payment (Hieu *et al.,* 2017). Hence, there is the need to design policy and institutional arrangements around PES programs (Andrew and Masozera 2010). Ostrom's design principles provided useful entry points in studying the functioning of the committees. One of the eight design principles was used to examine the governance of PES, which is, monitoring.

The significant association between committee importance and perceived water quality is critical if monitoring systems are enhanced. Given the lack of capacity of WRA to manage water resources, NGOs (WWF and GTZ) are helping build capacity to address the issue of governance through the devolved roles of the national government to the counties as stipulated in the Water Act 2016. Numerous policies have been introduced by the Government of Kenya to support the

water resource management. Progress has been made especially with the amendment to the Water Act, hence, the Water Act 2016. There is the need to ensure appropriate water resource policy and the participation of the communities to be strengthened at the basin management level. Devolution is a policy and process that has the potential to improve local livelihood and enhance decision making. The need to develop policies to address local and regional institutional frameworks that can cope with complexity and diversity and integrate PES within other policy instruments for environmental protection is critical (Muradian and Rival 2010). These are the basis for the enhanced role of "community participation" as they reinforce the need to interpret constitutional provisions to ensure that all elements of public participation play an effective role in decision making. A study in Kenya, undertaken by (Wangai *et al*., 2016) investigated the influence of decision-making at local, regional or national level. The results suggest that decision making on ecosystem services in Africa are not homogenously distributed (Wangai *et al.*, 2016). Hence the need to strengthen decision making at all levels through local committees, regional and national bodies.

To attract more private sector participation in PES and to improve agricultural practices, the government institutions in Kenya should gradually be proactive with their involvement through the county government.

The policy intervention failures due to a lack of consistency among government policies arise due to the insufficient understanding of the functions and values of wetlands (Schuyt 2005). Article 42 of the constitution provides that the environmental right shall be realized through legislative whereas Article 69, highlights the need to ensure sustainable management and conservation of the environment (Kibugi 2014).

7.4 CHAPTER CONCLUSION

This paper discussed the policies introduced by the government of Kenya to support the water resource management. Though, progress has been made, with the introduction of the Water 2016, the results still indicated weak decision making at the lower levels of governance as the county officials are yet to be fully involved in the PES decision making. There is still a lack of policy framework addressing PES specific issues.

There is the need to ensure appropriate water resource policy (which ensures the management of watershed and water quality) and the participation of the communities (wealthy, poor) to be strengthened at the basin management level.

There is a need for coordination between different actors, and there is the need to develop policies to address local and regional institutional frameworks that can cope with complexity and diversity and integrate PES within other policy instruments for environmental protection is critical.

8 CONCLUSION AND RECOMMENDATIONS

8.1.1 Overall discussion

The main drivers for assessing the effectiveness of PES in LNB are; (a) title deeds; (b) the impact of extension services and cost of agricultural inputs; (c) WRUA committee importance and formation and finally (d) policy modification to enhance PES implementation.

8.1.2 Conclusion

This thesis concluded that there is a general high knowledge of protected areas and knowledge of water regulations. This thesis has shown a significant relationship between (a) title deeds and water quality (b) the impact of extension services, cost of agricultural inputs and conflict and (c) committee importance and water quality.

The conflict experience at the study area was based on lack of cooperation, as farmers before the introduction of PES did not have a better understanding of conservation management. As the number of farmers with no knowledge of negotiation increases, the likelihood of experiencing conflicts increases, also as the impact of the extension services increases, the capacity of the farmers to adopt good practices and reduce tensions increases. As farmers who agree on the importance of committees' increases, the likelihood of appropriate structures governing the operations of the committees be instituted.

Majority of the respondents indicated that they were small-scale farmers, with a mean farm size of 3.35 acres, where the minimum is 1 acre and the maximum is 35 acres.

Finally, numerous policies have been introduced by the Government of Kenya to support the development of the agricultural sector. Therefore, there is the need to ensure appropriate policies to enhance the effectiveness of PES and also ensure the participation and strengthening of communities at the basin management level.

8.1.3 Recommendations

In this section, the thesis sets out key recommendations set out by the research questions that have guided this research:

8.1.3.1 Land registration documentation

It is recommended that farmers have title deeds of their farms as it influences their 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.

8.1.3.2 Enhancement of institutional cooperation

On the issue of the level of cooperation between the institutions and society, it is recommended that 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.

8.1.3.3 *Policy modifications recommendation*

It is recommended that the government of Kenya develop an expanded policy agenda on PES which will include issuing of title deeds, methods of cooperation and WRUA committee formation. In line with the Water Act 2016, the government of Kenya will need to create a national policy agenda on PES, which would include:

(1) the prioritization of agricultural extension services as part of a national multi-sectoral integrated water resource management network; and

(2) the allocation of funds for institutional and management reorganization (for example WRUA committees).

The national policy agenda to be developed on PES will then hope to achieve the effectiveness of PES through cooperation among the relevant sectors to develop programmes for PES to achieve improved water quality and conflict reduction.

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Annex 1: Questionnaire

PES evaluation (PES member)

Basic Information

Name of enumerator**(your name)*

Name of Village*

Name of Location*

Name of sub-county*

GPS Coordinates* latitude (x.y °)longitude (x.y °)altitude (m)accuracy (m)

Name of respondent**the person to be interviewed*

Gender of respondent*

○ Male ○ Female

Marital Status*

○ Married ○ Single ○ Divorced ○ Widow ○ Widower

Gender of household head*

○ Male ○ Female

Telephone Number*

Age of respondent*

○ 18-35 ○ 35-60 ○ 60+

Household size*

○ less than 5 ○ 5-10 ○ 10+

Number of dependents (nonfamily)*

○ less than 5 ○ 5-10 ○ 10+ ○ None

Occupation of respondent**(tick one)*

○ livestock keeping ○ farmer (subsistence) ○ horticulture ○ Government ○ business ○ others

Level of education*

○ None ○ Primary ○ Vocational ○ Secondary ○ College ○ University

General land information

Land use Tenure System*

○ Private ownership ○ Communal land ○ Government trust land

Land ownership document type*

○ Title deed ○ Allotment letter ○ Sufficient authority (land leases or other agreement)

The scale of farming practice*(tick one range)

◉ Small-scale (less than 5 acres) ○ medium scale (5 to 12.5) ○ large-scale (more than 12.5)

Land use*(tick one or more)

☐ subsistence farming ☐ commercial farming ☐ livestock farming ☐ forestry(woodlots) ☐ agro-forestry

Source of water*(tick one)

○ Rain harvesting ○ Shallow well ○ Borehole ○ Piped main supplies ○ Independent water vendors ○ From the river ○ Others

Farm Size*(in acres)

Remittances

Do you receive financial support*(from friends and family)

○ Yes ○ No

Has the household received any of the following*

☐ Education bursary ☐ Food aid ☐ Agricultural inputs ☐ Remittances from outside ☐ None

Farm income

Estimated farm sales per annum*(in Ksh)

○ below - 50, 000 ○ 50,000 - 75,000 ○ 75,000-150,000 ○ Above 150,00

Estimated off-farm income*(per annum) (business, salaried)

○ below - 50, 000 ○ 50,000-75,000 ○ 75,000-150,000 ○ 150,000+

Estimate how much you spend on food*(monthly)

● less than 1000 ○ 1000 - 3000 ○ 3000 - 5000 ○ 5000+

Estimate how much you spend on household expense*(monthly) (parrafin etc)

○ less than 3000 ○ 3000 - 5000 ○ 5000+

Estimate how much you spend on education*

○ None ○ below 20,000 ○ 20000 -50000 ○ 50000+

Estimate how much you spend on health*

○ less than 1000 ○ 1000 - 3000 ○ 3000 - 5000 ○ 5000+

Estimate how much you spend on contributions to groups*(monthly)

○ less than 1000 ○ 1000 - 3000 ○ 3000 - 5000 ○ 5000+

Member of associations or cooperatives*Select the cooperatives/ associations that you are a member

☐ Agriculture or livestock ☐ Tourism or conservation association (CFA, WRUA Environmental Groups etc) ☐ Community Association (Women, men, youth, church, etc) ☐ Development Association (eg Merry-go-round, table banking, women, youth, etc) ☐ None

Affordability of agricultural inputs*

○ high ○ medium ○ low

Access to farm gate*

○ high ○ medium ○ low

Access to national market*

○ high ○ medium ○ low

Access to international market*

○ high ○ medium ○ low

Access to government subsidies*(tax exception)

○ high ○ medium ○ low

Access to finance*

○ high ○ medium ○ low

Impact of extension services*

○ high ○ medium ○ low

List three factors that affects you*(select three)

☐ quality of river water ☐ input cost for agriculture ☐ access to national market ☐ access to international market ☐ government agricultural subsidy ☐ payment for ecosystem services ☐ dairy prices ☐ access to finance and loans ☐ extension services and technical assistance

Date of PES Enrolment*When did the respondent first join PES

[   ]

Water quality before PES*

○ Very poor ○ Poor ○ Average ○ Good ○ Very good

Water quality after PES*

○ Very poor ○ Poor ○ Average ○ Good ○ Very good

Conflict

Do you experience conflict over water?

○ yes ○ no

If yes rate the conflict

○ high intense ○ low intense

Conflict involves

○ Households (i.e. neighbours)○ Between clans/tribe○ Different water projects○ farmers and pastoralists○ water users and authorities○ Between users and conservationist

Where conflict reported

● Provincial administration○ Community water project officials○ WRUA officials○ Local ministry of water official○ NGOs○ Faith-based organisation○ Police/security apparatus○ not reported

Form of conflicts

○ Tension/animosity○ Quarrels/verbal exchange○ Fighting○ Loss of property

Actions to resolve conflict

○ Arbitrate between feuding parties○ Arrest culprits○ Send warning to culprit○ Hold reconciliation meetings○ Nothing○ Legal redress○ Advise on alternative water sources ○ Enforce the law accordingly

What is your opinion causes water resource use conflict

☐ Over-abstraction☐ Illegal abstraction☐ Water pollution by upstream☐ Lack of overseeing authority☐ Inadequate Legal and policy framework☐ Poor enforcement of laws ☐ Weak local institutions

Access to credit

Have you had a new farm investment*(in the past 10 years)

○ Yes○ No

Had total cultivated land area increased*

○ Yes○ No

Have you taken credit the past 10 years*

○ Yes○ No

Knowledge about environmental legislation

Do you know what a protected area is*(riparian)

○ Yes ○ No

How much do you know about water regulation*(1-high; 2-medium; 3-low)

Access to information

Have you participated in meetings about PES*

○ Yes ○ No

Have you been visited to discuss the scheme*(by PES coordinators)

○ Yes ○ No

PES members

Three main reasons why you participate in PES*

☐ Cash payment (supplement family income)

☐ Technical assistance

☐ Improve my farm production

☐ Increase my farm production

☐ Encouragement by a third party

Community associations has a positive impact

○ strongly agree ○ agree ○ Neutral ○ disagree ○ strongly disagree

Can you continue with PES without any support*

○ Yes ○ No

WRUA accountability

The WRUA committee is answerable for its decisions.*(1-strongly agree; 2-agree; 3-neutral;4-disagree;5-strongly disagree)

The WRUA committee will be informed of illegal water activities*(1-strongly agree; 2-agree; 3-neutral;4-disagree;5-strongly disagree)

PES farmers depend on the WRUA committee's successes or failures*(1-strongly agree; 2-agree; 3-neutral;4-disagree;5-strongly disagree)

The WRUA committee's role is important.*(1-strongly agree; 2-agree; 3-neutral;4-disagree;5-strongly disagree)

WRUA committees are trusted*(1-strongly agree; 2-agree; 3-neutral;4-disagree;5-strongly disagree)

Do you know the negotiations process between the buyers and sellers*(upstream sellers and downstream buyers)

Ecosystem Valuation

Benefits of PES to the environment*(select three)

☐ Provision of biodiversity and conservation

☐ Provision of water resources

☐ Provision of recreational services

☐ Provision of livelihood improvement

☐ Provision of fodder

Number of trees before PES per acre*(before 2007) (indigenous)

Number of trees after PES per acre*after 2007 (indigenous)

Irish potatoes before PES*(bags) (before 2007)) (annual)

Irish potatoes after PES*(after 2007) (bag)) (annual)

Green peas before PES*(before 2007)) (annual) (kiligrams)

Green peas after PES*(after 2007)) (annual)

Maize before PES*(before 2007)) (annual) (bags)

Maize after PES*(after 2007) (bags) (annual)

Carrots before PES*(before 2007)) (annual) (bags)

Carrots after PES*(after 2007)) (annual) (bags)

Cabbage before PES*(before 2007) (heads)) (annual)

Cabbage after PES (after 2007) (annual) (heads)

Snow peas before PES*(kgs) (before 2007)

Snow peas after PES*(kgs)

Number of dairy cow before PES*before 2007

Number of dairy cow after PES*(kgs) (after 2007)

Liters of milk before PES*(before 2007)

Liters of milk after PES*(after 2007)

Amount of fertilizer before PES*(kgs) (before 2007)

Amount of fertilizer after PES*(after 2007) (kgs)

PES Evaluation (Non-PES)

Basic Information

Name of enumerator*(your name)

Name of Village*

Name of Location*

Name of sub-county*

GPS Coordinates*

latitude (x.y °)longitude (x.y °)altitude (m)accuracy (m)

Name of respondent*the person to be interviewed

Gender of respondent*

○ Male○ Female

Marital Status*

● Married○ Single○ Divorced○ Widow○ Widower

Gender of household head*

○ Male○ Female

Telephone Number*

Age of respondent*

○ 18-35 ○ 35-60 ○ 60+

Household size*

○ less than 5 ○ 5-10 ○ 10+

Number of dependent (non family)*

○ less than 5 ○ 5-10 ○ 10+ ○ None

Occupation of respondent*(tick one or more)

○ livestock keeping ○ farmer (subsistence) ○ horticulture ○ Government ○ business
○ others

Level of education*

○ None ○ Primary ○ Vocational ○ Secondary ○ College ○ University

General land information

Land use Tenure System*

○ Private ownership ○ Communal land ○ Government trust land

Land document type*

○ Title deed ○ Allotment letter ○ Sufficient authority (land leases or other agreement)

Scale of farming practice*(select one)

○ Small-scale (less than 5 acres) ○ medium scale (5 to 12.5) ○ large-scale (more than 12.5)

Land use*(tick one or more)

☐ subsistence farming ☐ commercial farming ☐ livestock farming ☐ forestry(woodlots)
☐ agro-forestry

Source of water*(tick one)

○ Rain harvesting ○ Shallow well ○ Borehole ○ Piped main supplies ○ Independent
water vendors ○ From the river ○ Others

Farm Size*(in acres)

Remittances

Do you receive financial support*(from friends and family)

○ Yes ○ No

Has the household received any of the following*

☐ Education bursary ☐ Food aid ☐ Agricultural inputs ☐ Remittances from outside ☐ None

Farm income

Estimated farm sales per annum*(in Ksh)

○ 50,000 - 75,000 ○ 75,000-150,000 ○ 150,000+ ○ below 50000

Estimated off-farm income(per annum) (business, salaried)

○ 50,000-75,000 ○ 75,000-150,000 ○ 150,000+ ○ below - 50, 000

Estimate how much you spend on food(monthly)

○ less than 1000 ○ 1000 -3000 ○ 3000-5000 ○ 5000+

Estimate how much you spend on household expenses*(monthly) (paraffin etc)

○ less than 3000 ○ 3000-5000 ○ 5000+

Estimate how much you spend on education*(monthly)

○ none ○ below 20,000 ○ 20000 -50000 ○ 50000+

Estimate how much you spend on health*(monthly)

○ less than 1000 ○ 1000-3000 ○ 5000+

Estimate how much you spend on contributions to groups*(monthly)

○ less than 1000 ○ 1000-3000 ○ 5000+ ○ None

Member of associations or cooperatives*(tick one or more)

☐ Agriculture or livestock ☐ Tourism or conservation association (Environmental Groups etc) ☐ Community Association (Women, men, youth, church, etc) ☐ Development Association (eg Merry-go-round, table banking, women, youth, etc) ☐ None

Affordability of agricultural inputs*(fertiliser etc) (tick one)

○ High ○ medium ○ low

Access to national market*

○ High ○ medium ○ low

Access to international market*

○ high ○ medium ○ low

Access to government subsidies*

○ High ○ medium ○ low

Access to finance*

○ High ○ medium ○ low

Impact of extension services*(on farms)

○ high ○ medium ○ low

Water quality before 2007*

○ Very poor ○ Poor ○ Average ○ Good ○ Very good

Water quality after 2007*

○ Very poor ○ Poor ○ Average ○ Good ○ Very good

Conflict

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○ Yes ○ No

If yes, rate the conflict*

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○ Arbitrate between feuding parties ○ Arrest culprits ○ Send a warning to culprit ○ Hold reconciliation meetings ○ Nothing ○ Legal redress ○ Advise on alternative water sources ○ Enforce the law accordingly

What is your opinion causes water resource use conflict*(select one or more)

☐ Over-abstraction ☐ Illegal abstraction ☐ Water pollution by upstream ☐ Lack of overseeing authority ☐ Inadequate Legal and policy framework ☐ Poor enforcement of laws

Access to credit

Have you made any new farm investment*(in the past 10 years)

○ Yes ○ No

Have you increased cultivated land area*

○ Yes ○ No

Credit was taken in the past 10 years*

○ Yes ○ No

Knowledge about environmental legislation

Do you know what a protected area is*(Ramsar site etc)

○ Yes ○ No

How much do you know about water regulations*(1- high knowledge, 2- medium knowledge, 3- no knowledge

Access to information

Have you heard about the PES scheme*

○ Yes ○ No

Have you been visited to discuss the scheme*(by PES coordinators/Agric staff)

○ Yes ○ No

Non-PES members

List the places where you heard about PES*

☐ Farmers ☐ Church ☐ community meetings

I have adopted some of the PES practices*(through observing PES farmers)

○ Yes ○ No

I have knowledge about the PES scheme*

○ Yes ○ No

I am willing to enroll in the PES scheme*

○ Yes ○ No