REPUBLIC
OF
KENYA

Poverty Reduction Through Sustainable NRM

INTERNATIONAL
FUND FOR
AGRICULTURAL DEVELOPMENT

MINISTRY OF ENVIRONMENT, WATER & NATURAL RESOURCES

UPPER TANA NATURAL RESOURCES MANAGEMENT PROJECT (UTaNRMP)

BASELINE SURVEY REPORT
JUNE 2014

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ACKNOWLEDGEMENTS

We would like to thank the following persons who contributed immensely to the Baseline Survey and the compilation of the following report.

First, the Upper Tana Natural Resources Management Project for contracting us to undertake this study. We especially recognize the support of the Project Coordinator, Ms. Muthoni Livingstone, and all members of the Project Coordinating Team, and especially the Component managers, and the Monitoring and Evaluation Officer Mr. Justus Makau who supervised the survey.

We also acknowledge the support given by the County Project Coordinators in all the six counties, and the respective members of their County Project Facilitating Teams, and key informants interviewed. Further, we would also like to appreciate the support given in the field data collection by the various Water Resources users Associations (WRUAs), Water Users Association, Community Forest Association (CFAs), Common Interest Groups (CIGs), Community Based Organizations (CBOs) and Self Help Groups (SHGs), Non-Governmental Organizations (NGOs), and households.

We also wish to thank the members of the Project Steering Committee (PSC) and all the participants of the validation workshop for their useful critique and comments which have greatly enriched the final report.

ACRONYMS

AIA	Appropriation In Aid
AIE	Authority to Incur Expenditure
AIDS	Acquired Immuno-Deficiency Syndrome
AMREF	African Medical and Research Foundation
AP	Permit application
ASL	Above Sea level
ASAL	Arid and Semi-Arid Lands
AU	Authorization
AVG	Average
AWPB	Annual Work Plans and Budget
CAPs	Community Action Plans
CAPP	Consolidated Annual Procurement Plan
CBO	Community Based Organization
CFA	Community Forest Association
CIDP	County Integrated Development Plans
CIG	Common Interest Group
CPC	County Project Coordinator
CPCC	County Project Coordinating Committee
CPFT	County Project Facilitating Team
CRECO	Constitution and Reform Education Consortium
d/s	downstream
EA	Environmental Audit
ECD	Early Childhood Development
EIA	Environmental Impact Assessment
FDA	Focal Development Area
FDAC	Focal Development Area Committee
FGD	Focused Group Discussion
G	Groundwater
GEF	Global Environmental Facility
GIZ	German International Cooperation (Gesellschaft für Internationale Zusammenarbeit)
GoK	Government of Kenya
Ha	Hectare
HDI	Human Development Index
HH	Household
HIV	Human Immunodeficiency Virus
ICB	International Competitive Bidding
IFAD	International Fund for Agricultural Development
IGA	Income Generating Activity
KARI	Kenya Agricultural Research Institute
KCPE	Kenya Certificate of Primary Education
KENAO	Kenya National Audit Office
KEMU	Kenya Methodist University
KFS	Kenya Forest Service
KG	Kilogram
KM	Kilometre
KNBS	Kenya National Bureau of Statistics

KMTC	Kenya Medical Training College
KM&L	Knowledge Management and Learning
Kshs	Kenyan Shilling
KWFT	Kenya Women Finance Trust
KWS	Kenya Wildlife Service
LCB	Local Competitive Shopping
LPO	Local Purchase Order
LSO	Local service Order
LS	Local Shopping
M&E	Monitoring and Evaluation
MKEPP	Mount Kenya East Pilot Project
Mm	Milli Metre
MoEW&NR	Ministry of Environment, Water and Natural Resources
MoALF	Ministry of Agriculture, Livestock and Fisheries
MRL	Maximum Residue Level
MT	Metric Tonne
NCB	National Competitive Bidding
NEMA	National Environment Management Authority,
NGO	Non-Governmental Organization
NIB	National Irrigation Board
NRDS	National Rice Development Strategy
NRM	Natural Resources Management
PCT	Project Coordinating Team
PE	Permit
PELIS	Plantation Establishment and Livelihood Improvement Scheme
PFM	Participatory Forest Management
PFMP	Participatory Forest Management Plan
PMC	Project Management and Coordination
PSC	Project Steering Committee
R&D	Research and Development
ROSCA	Rotating Savings and Credit Association
S	Surface water
SACCO	Saving and Credit Cooperative Organization
SCMP	Sub Catchment Management Plan
SER	Special Exchequer Requisition
SHG	Self Help Group
SWC	Soil and Water Conservation
TOR	Terms of Reference
TWSB	Tana Water Service Board
UTaNRMP	Upper Tana Natural Resources Management Project
u/s	upstream
WA	Withdrawal Application
WDC	Water Resources Users Association Development Cycle
WRMA	Water Resources Management Authority
WRUA	Water Resources Users Association
WSB	Water Services Board
W/S	Water Supply
WSC	Water and Sewerage Company
WP	Water Project
WSRB	Water Services Regulatory Board

WSTF	Water Services Trust Fund
WUA	Water Users Association

EXECUTIVE SUMMARY

Background

Kamfor Company Limited was contracted by Upper Tana Natural Resources Management Project (UTaNRMP) to carry out a baseline survey in the project area inorder to establish the conditions at the start of project implementation. Baseline information/data is important in monitoring and evaluation as it helps to set key benchmarks which will be used to measure whether the project interventions has had measurable outputs, outcomes and impacts. The survey took 12 weeks from March - May 2014.

The objectives of the baseline survey were to:

i. Generate baseline information/data to assist in assessing the project area situation at the beginning of the project
ii. Set bench marks/indicators to inform the M&E function of the project and form a platform for assessing the impact of the project and other project surveys.
iii. Provide comprehensive information for planning and decision-making besides providing benchmarks against which programme interventions will be assessed and will be a reference point when organizing other surveys.

The baseline information/data was collected under six main thematic areas: Socio-Economic; Water Resources; Environmental Conservation; Agricultural/Rural livelihoods, Project Management and Coordination, and Community Empowerment. The baseline survey initially focused on the tributaries of the four river basins covered under Mount Kenya East Pilot Project for Natural Resources Management (MKEPP-NRM, UTaNRMP's predecessor) and the 12 high priority river basins. This was later changed to cover the whole project area, including the other 12 river basins.

Survey Approach and Methodology

The approach to the survey focused on responding to the scope of work and activities given in the terms of reference.The consultants' team maintained consultative discussions with the client over the entire period of the assignment.

The survey started with collection of secondary data and preparation of data collection instruments, namely a household questionnaire, Key Informant Interview Guide, Focused Group Discussion Guide, and an Observation Guide. The project areas were then disaggregated along the river basin boundaries used by the Water Resource Users Associations (WRUAs). Sampling of Households was then undertaken using stratified random sampling with an overall sample size of 864 households was taken. Field visits to the river basins were also made to conduct household interviews, focused group discussions, and observations. A total of 42 Focused Group Discussions and 132 Key Informant Interviews were held. Data collected was then analyzed and draft report prepared which was then presented to a stakeholders' validation workshop.

Socio-Economic Aspects

The project area has an estimated population of 5.2 million people. Communities across the target area have many similarities in their culture and traditions. Slight differences in cultural practices however exist within the sub-groups around the counties especially in Kirinyaga, Embu, Tharaka Nithi and Meru. However, people settled in Murang'a and Nyeri are fairly homogenous. Poverty levels vary from 25.2% in Kirinyaga to 48.7% in Tharaka Nithi. These rates were based on the Commission of Revenue Allocation Report (2012). Human Development Indices for the counties range from 0.55 in Tharaka Nithi to 0.64 in Nyeri. The national average is about 0.58. Life expectancy at birth ranges from 59 years in Tharaka Nithi to 65 years in Embu. The national average is 58 years.

Literacy levels at the county level show that Nyeri County had highest rates of 95% for male and 88% for female, while Meru had the least at 78% for male and 74% for female (Economic survey 2014). Across the river basins the farmers who reported to have primary level education as the highest level were 30%, while those with secondary education as the highest were 38%. Another 22% reported that they had college/university education. All counties showed a near gender parity in enrolment in both the Early Childhood Development Education (ECDE) and primary levels, but this significantly differs in secondary level, where more females appear to be enrolled compared to male. This may have a positive impact on project implementation since high education levels make people easily conceptualize implementation of policies, project objectives and implementation approaches.

In regard to health, all counties except Nyeri had fewer than the recommended World Health Organization (WHO) minimum ratio of medical personnel per persons. The population per doctor ratio was high across the counties. All counties had less than ten (10) level-4 district hospitals except Meru which had 14. All counties, except Tharaka Nithi, each had one (1) level-5 or provincial hospital. In general, the counties were noted to be relatively peaceful with minimal internal conflicts. However, there are major risks that pose significant threats to the harmony in the counties. These include youth unemployment, alcohol and substance abuse and, inequalities (economic and infrastructural) within the respective counties. Project interventions have the potential to mitigate this by engaging these groups constructively.

Average household size across the river basins is 6 people. According to the study, the average income across the river basins ranged from Kshs. 10,000 to Kshs. 320,000 per year (Kshs. 833-Kshs. 26,667 per month). This implies that the lowest categories of the beneficiaries are earning US$ 9.8 per month translating to US$ 0.33 per day. These are poor people whom the project should target in the implementation of project activities.

Sale of agricultural products was listed by about 80% of households as the main source of income, followed by casual labour (40%). On average less than half the respondents (43%) had title deeds.

According to study findings, housing types were semi-permanent (47%), permanent (40%) and temporary (11 percent). Piped water (inclusive of water kiosks) was available for 61 percent of people interviewed (homestead had 46%) while 31 percent used river water. On average the distance covered to the nearest source was 1.4 Kms. Additionally kerosene was the main source of lighting fuel as reported by 67 percent of the respondents followed by electricity (21 percent). Firewood was the mainsource of cooking energy for 85 percent of the people while 8 percent used charcoal.

On asset ownership and access, the mobile phone, radio, television sets and water tanks were the most common assets as mentioned by 82%, 73%, 42% and 41% of the respondents respectively. County level reviews of the census data further show that the access to radio ranged from 79.3% in Meru to 91.7% in Nyeri. The national average was 76.6%. Ownership of mobile phones ranged from 50.7 % in Murang'a to 71.8% in Nyeri, while the national average was 51.4%. Similarly access to the TV ranged from 25% in Murang'a to 54.4 % in Nyeri and the national average was 35.2 %.

About 62% of the respondents reported they were involved in community based groups, and primarily self-help groups. Awareness on the existence of WRUAs was reported by 52% while that of CFAs was reported by 35% of the respondents. Further 63% of those interviewed were aware of people living with disabilities among them but only 21% were aware of any support given to them.

Cooperative societies, SACCOs, women groups and youth groups were the most common forms of organisations across the six counties. Cooperatives were more in agriculture; SACCOs were more common in trade and housing activities while women groups and youth groups were more geared to supporting member's social welfare, though most were also involved in many Income Generating Activities in the agricultural, trading among other sectors. Most women and youth groups were registered as Self Help Groups (SHGs).

The key recommendations for the socio-economic issues are:

i. Sub-catchment Management Plans (SCMPs) may need to more prominently highlight socio-economic issues at the community level. A review of most SCMPs shows that more attention is paid to water resource and environmental challenges. Social aspects and challenges that may affect implementation of the plan such as leadership challenges, community organization etc. needs to be analysed and understood from the onset.
ii. The project will need to devise a mechanism of flagging out people within the river basins that could be facing unique challenges such as single mothers without access to land, persons with disability, the elderly and others with special needs. Approaches for social inclusion of these categories of people will need to be thought through and income generating activities targeting them designed.
iii. There is need for the project to make use of the high levels of education reported in the river basins by ensuring supply of relevant information through available forms of media such as print and cell phones.

iv. The river basins were not homogenous as each had its own unique aspects. As such project interventions will need to be river basin specific if they will make sense to farmers.
v. It will add value for the project to partner closely with other actors such as department of social development, to deliberately design interventions for the people with special needs. Social inclusion of all farmers is essential in poverty reduction efforts.
vi. The number of people reporting that casual labour was a source of income was high. Additionally, hired permanent and temporary labour was common across the river basins. It is important to note that those involved in farm labour may not always be the owners of the land, but they could be hired labour. This has implications on many issues such as decisions made in relation to production and target groups for capacity building.

Water Resources Management

The livelihoods of most of the people revolve around the use of the natural resources especially water. They are involved in activities where they use and manage the water for their livelihoods and income generation. The Upper Tana is home to the hydropower dams, the source of most of the water for Nairobi City County and two key water towers (Mt. Kenya and Aberdares) in Kenya. The Upper Tana is experiencing considerable land degradation and reduction of surface water availability during the dry seasons plus poor water quality during the wet seasons. Degradation has been caused by many factors including encroachment into the forests, wetlands and riparian areas as people look for arable land for enhanced food production to feed the increasing population, poor farming practices, over sub-division of land due to population pressure, pollution, unplanned urban development, poor water utilization technologies and poor awareness on environmental governance among other causes.

Pollution of water in the river basins in the catchment was from both point and diffuse sources. Point sources were mainly factories, small towns and urban centres, sewerage plants, and toilets. Diffuse sources included farms which produce residual fertilizers and pesticide which pollute surface and ground water, especially where irrigation is practiced. Silt is another pollutant and usually from farmlands, roads, quarries, degraded areas. Upcoming markets and towns where solid and liquid waste is not managed well contribute to pollution of water resources while linen washing (domestic washing) along rivers is another source of pollution. Wetlands, which play an important cleansing role for water systems area also under threat, compounding the problem of pollution.

The infrastructure in the water projects are mostly piped water delivery systems with intake works. However there also exists some farrow water furrow systems. Generally, most of the infrastructure has low efficiency because of poor maintenance. Wear and tear over time is common hence systems require replacement and upgrading. Due to this problem of infrastructure, the Unaccounted for Water (UFW) in some systems is as high as 60%

(compared to the national average of 45%). Overall, the state of the infrastructure is worse in community water systems when compared to that of private companies.

It is therefore necessary to combine sustainable water conservation and management in the upper Tana catchments with tangible gains in farm incomes, and other relevant income generating profits to all. This therefore provides sustainable income alternatives to destructive utilization of the catchment and the natural resources. Because of the serious nature of the problem, the catchment is targeted for increase in sustainable food production and income for poor rural households in the area while managing the natural resources like water sustainably.

Involvement of Water Resources Users Associations (WRUAs) and Water Users Associations (WUAs) which are Community Based Organizations is necessary in order to achieve sustainable catchment management. The WRUAs and WUAs currently exist within the river basins and have challenges which if addressed they can be positively used by the community. Therefore there is need to strengthen the capacity of WRUAs and WUAs.

The situation and conditions of the water resources needs to be addressed especially the challenges facing the wetlands, springs, dams and the hotspots which are the degraded areas of the catchment.

The people living in the area require safe and clean water while food production should be adequate and incomes for households should be reasonable and sustainable.

The baseline study established that there are operational WRUAs in 69% of the river basins. They however require a lot of assistance to achieve the expected objectives by assisting them to implement their Sub-Catchment Management Plans (SCMPs). Only 28% of households have treated water while 46% are connected to a water project. Findings indicate that 40% of the population in the river basins practice irrigation, however only about 5.5% of this uses drip which is an improved and modern irrigation methods. It was established that about 40% of wetlands have been encroached while 17% of springs have been drying due to human activities. All environmentally degraded areas identified require urgent protection and rehabilitation.

Therefore through WRUAs, WUAs and other organizations, the community can be engaged in activities which guarantee their livelihoods and sustainable income while managing the natural resources sustainably.

Key recommendations for water resources management include:

i. Formation of WRUAs in basins where there are none (22 WRUAs proposed) to have a fora for catchment management.
ii. Support to develop SCMPs (15 WRUAs formed but have no SCMP) to identify issues to be addressed in the sub catchment.
iii. Support to community water projects for both irrigation and domestic water.

iv. Support to implement activities of SCMPs (18 WRUAs with SCMPs but no implementation) for effective water resources management.
v. Unregistered WUAs need to be registered by the Tana Water Service Board so as to cover more areas and to connect more people with safe drinking water. The project can target 76 water projects which abstract over 1000 m^3 per day and are not yet registered with the Board.
vi. Support the continuous rehabilitation of water supply systems when they break down to ensure efficiency in operations and reduce the amount of water that is unaccounted for.

Environmental Conservation

The main aim of the environment component is to address the catchment degradation and the serious environmental challenges in the Upper Tana due to its socio-economic importance to the country. Indeed, one of the key project objectives is the sustainable management of natural resources for provision of environmental services. To do this, the project will work with local community groups like the Community Forest Associations (CFAs).

The CFAs are duly recognized and registered groups with the Attorney General's office and comprise of forest adjacent communities living up to 5 km from the forest boundary, and who are recognized under the Forest Act as co-managers of the forests using Participatory Forest Management. They play an important role in co-management of forests through Participatory Forest Management approach. Ordinarily, each forest station has one CFA. In the Upper Tana Regions, there are 39 CFAs formed (as of 30th March 2014) in the various forest stations and around some hills. CFAs have generally changed the relationship of the forest adjacent communities with the Kenya Forest Service. This is because, through the CFA, communities have been able to accrue direct and indirect benefits from the forests. The communities also feel they own the forest and talk of it as their resource. They are thus able to protect and conserve it.

Environmental hotspots in the agricultural lands in the Upper Tana catchment occur and manifest themselves in different forms, with the most common on-farm form of environmental degradation being soil erosion.

Soil erosion manifests itself through loss of topsoil and subsequent low fertility and low agricultural yields; occurrence of gullies; and significant sedimentation of water bodies downstream of agricultural areas. Erosion is however more prevalent in the middle zones, especially in the coffee growing zones. Another form of soil erosion is collapsing of river banks due to farming in the riparian areas. Grazing areas especially near livestock watering points are also prone to degradation, while sand harvesting in rivers also leads to both pollution and land degradation including collapse of river banks.

Landslides are a form of serious soil erosion. They are more prone on steep slopes and usually happen after heavy rains. Quarries fall under two categories, those which mine stones

and ballast, and those which mine murrum. They are point sources of pollution, degrade the environment, and they are rarely rehabilitated after exploitation.

Most wetlands, floodplains and riparian areas have been converted into small holder agricultural land throughout the catchment. The challenge is mainly in the rice growing areas where virtually all large and small wetlands have been put under rice growing. Indeed, instead of being the '*lungs of the earth'* by performing their cleansing functions of water, wetlands have become points of pollution. Some wetlands in the catchment are also targeted for clay and brick making.

All the urban centres in the Upper Tana catchment are point sources of pollution to the water bodies. This is because they lack proper solid wastes disposal systems/sites. Interestingly, where they occur e.g. Nyeri and Embu, the sewerage systems have also been mentioned as pollution sources.

Hilltops are under threat in the Upper Tana especially due to lack of protection and as such suffer environmental degradation from unsustainable exploitation for dry season livestock herding and charcoal production. The problem of tenure (over 60% of hilltops not gazetted) has made rehabilitation of hilltops difficult. Efforts to gazette some of them and form CFAs have however been made.

Forest areas are also degraded with both the Aberdares and Mt. Kenya having about 7,500 ha in need of rehabilitation according to the survey findings.

Other environmental challenges in the Upper Tana include Human-Wildlife conflicts, with the survey indicating that approximately 35% of households experienced human wildlife conflicts. The main type of conflict is invasion of farms by wild animals, which results in crop destruction, though there were sometimes human injuries and even deaths on one hand, and wildlife also being killed.

The survey indicates that 83% of households use the three stone jiko, while 13% used improved cook stoves. Muranga County has the highest use of improved firewood and charcoal stoves due to availability of local materials for making liners.

Charcoal was usually (87%) purchased from local markets, with some households making their own (24%) at times. Most households (70%) did not know the source of their charcoal but it was however said to be made using traditional earthen kilns other than that produced at Kakuzi Ltd where efficient charcoal producing kilns are used. Two groups of charcoal producers had also been registered in Meru County.

Lighting was predominantly through use of kerosene with the whole catchment registering 68% usage, followed by electricity at 21%. Electricity connections were high near small urban centres. Use of biogas was also low at 1%. Only 10% used green energy sources, mainly solar.

Very few persons had attended any environmental training courses, with only 12% of household members interviewed indicating they had attended such courses. Only 36% of the HH respondents were able to identify and name an environmental hotspot, with the highest percentages (average 52%) being in Thangatha, Kayahwe and Mariara.

The main environmental challenges listed across all river basins were water pollution (58%) and climate change (39%). The evidences of climate change were unpredictable and unreliable rainfall, which has led to low agricultural yields. Pollution was made manifest by diseases like typhoid and amoeba.

The main recommendation given includes:

i. 8 CFAs be assisted to formulate their Participatory Forest Management Plans and another 12 update their PFMPs as the plans are usually for 3 years.
ii. All the CFAs be assisted to implement activities planned in the PFMP.
iii. To assist KFS register charcoal producers and then train them in sustainable charcoal production.
iv. The project to promote use of efficient charcoal production kilns.
v. The project to assist in capacity building of players in the improved cook stoves value chain, specifically focusing on production of quality cook stoves, linking producers with markets, and also ensuring that a sustainable ICS market is created.

Agricultural/Rural Livelihoods

Agriculture is very critical to Kenya's economy. It contributes to rural employment, food production, foreign exchange earnings and rural incomes. The sector contributes 26 per cent of Kenya's Gross Domestic Product (GDP) and 27 per cent indirectly through linkages with manufacturing, distribution and other service related sectors. Agriculture is also critical in realization of Kenya's Vision 2030 and Millennium Development Goals (MDGs), especially that of reducing hunger and poverty.

Soil distribution within the project area ranges from dark grayish brown (very fiable, acidic humic) to peat and loam). In Meru County and Murang'a County, the soils vary from basement rocks in the upper zones, to volcanic foothill ridges in the central part, and humic topsoil of moderately high fertility in the lower altitude. In Nyeri County, the bedrock consists of volcanic rocks. On the highest parts of the mountains, soils of moderate to high fertility occur but it is too cold for any agricultural production. At a slightly lower altitude, soils with humic topsoil and a moderately high fertility are found and may be shallow or leached. In KirinyagaCounty, the soils range from volcanic to mountain soils which occur in broad zones from west to east, ranging from medium to heavy texture in the upper and lower parts. In Embu County, mountain soils occur in broad zones from West to East changing from a medium texture in the highest parts, over a medium to heavy texture in the middle, to a heavy texture in the lower parts. Soils in the Southern part of Embu County occur in varied patches and show mainly a heavy texture. The soils occur in broad zones which run

Southwest – Northeast and they are mainly heavy in the upper middle parts, mainly medium to heavy in the lower middle parts, and light to heavy in the lower parts.

The main economic activities in all the counties range from subsistence farming (maize, beans, potatoes, vegetables and tomatoes), cash crop (tea, coffee), to horticulture and livestock. The upper zones are mainly characterized by cash crops while the middle zones have subsistence farming and livestock and, the lower zones are mainly livestock production and cereals. The land use pattern is mainly food crop, cash crop and livestock farming. The main soil and water conservation areas include Makuyu, Kambiti, Kakuzi, Ithanga, Maragwa Ridge, Githuuri, which are affected by galleys and sand harvesting activities. On average the main soil and water conservation activities used are nappier grass, terracing and tree planting.

The percentage of farmers using certified seeds ranged from 35-80% with a similar correlation with use of fertilizers. It was noted that on average farmers are engaging in various technologies as follows: Aquaculture (17%), Apiculture (11%), Improved Chicken (23.2%), Rabbits (23%), Piggeries (28%), Dairy Goats (21.5%), Tree Farming (19.96%), and Commercial Fruit Growing (24.43%). A further 0.4% engages in other technologies.

Horticultural awareness within the 29 River Basins on average was 51%, where farmers who have adopted the practice are 38% with 11% who were uninformed. On average the main challenges to horticultural farming were diseases and pests, low rainfall, low prices, and market access.

The main livestock breeds within the 29 River Basins are Freshian, Guernsey, Ayshire, Boran, Sahiwal, and crosses of the same. Small stock comprise of goats, dairy goats, and sheep. Others are pigs, rabbits, improved chicken (broilers and layers), and indigenous chicken. Livestock is reared through zero grazing in the upper and middle zones, whereas in the lower zones free range is the preferred method. The preferred breeding method is Artificial Insemination (AI) but also Bulls are in use in some parts especially the lower zones for instance in lower Thiba river basin.

The market for food crops within all the River Basins is basically the local market, where it is bought by locals or middle men and sold to the tertiary market. Cash crops which are mainly tea and coffee are sold to the factories within localities where farmers are members. Horticultural crops grown are mainly French beans, avocadoes, bananas, passion fruits, onions and vegetables. The distance from the farm to the market ranged from the doorstep to 100 km in all the river basins.

Over 80% of the farmers are primary producers, selling their crops and livestock products at the farm gates. Some are organized into small groups for marketing purposes. There are only a few agro-processing industries, with the most common being for tea and coffee. There are also a few industries dealing with dairy products – milk cooling and processing, including for dairy milk. There is also a fish processing plant and a hatchery in the project area.

On the whole, horticulture, followed by rice were the biggest sources of income per unit area. Using the crop production figures in tables 3.51 for rice and 3.64 for horticulture, average incomes per hectare per year are Kshs 286,400 and 467,000 for rice and horticulture for the Upper Tana basin. Horticulture incomes however rise to as high as Kshs 796,000 and 692,000 per hectare per annum in Kirinyaga and Meru respectively; while those for rice are also higher in Kirinyaga at Kshs 480,000. The average maize yields for all river basins was 50 (90kg) bags owing to variation on acreage allocated for production, and the average production per acre was 42 (90kg) bags. At an average price of Kshs 3,233 per bag, average incomes per acre per annum was Kshs 134, 829 per annum.

On average 86% of farmers have access to credit in all River Basins, with 59% engaging in table banking. Equity bank is leading in giving credit, whereas Taifa and Muramati are the leading SACCOs in the River Basins. The major challenge is not the access to credit but the conditions for accessing the same and difficulties in repayment. The conditions for accessing credit are mainly collateral, savings, security for instance in terms of land title deeds and guarantors. Most people in the River Basins have bank accounts and also most of the Self Help Groups practice table banking.

Community Empowerment

Critical for project sustainability is the fostering the capacity of poor rural people and their organizations to pursue viable livelihoods and to shape the circumstances that affect them. This requires that communities and their institutions are empowered. Key areas for community empowerment will include financial management and book keeping by designing a simple accounting system and training the communities on its use; procurement in line with the public procurement and disposal act; and ensuring community involvement throughout the project. Capacity building on group leadership and dynamics as well as project management will be critical for sustainability.

Coordination and Management

The survey established that the project is being implemented through existing government institutions according to their mandates. The also survey established that most structures envisaged in the design like the Project Steering Committee, Project Coordination Team, were already in place and working, while others like the County Project Coordinating Committee and County Project Facilitation Teams were being put in place.

The new devolved structure of government will also be a challenge to project implementation as the new structures are still in their nascent stages and roles and responsibilities between the national and county government structures are still evolving. In the same vein, the survey established that there is a gap in terms of implementation teams at the sub county and ward level. After the CPFT at the county level, the next collaborating organization are the WRUA/ CFA which are at the river basins/forest station level. There is therefore a need for the project

to introduce a project management structure at the sub county levels so as to effectively coordinate project implementation at that level.

The study further noted that the project is in the process of designing M&E system and necessary M&E teams at various levels are in the process of being established. It was however noted that the knowledge of M&E is still low at the counties and other devolved units.

The project procurement is being guided by the Public Procurement and Disposal Act (2005) and IFAD procurement guidelines. The project has prepared procurement manual which will give a guide to the procurement at all level including the community level.

It is recommended that:

i. The project undertake capacity building in financial management, business skill, procurement, M&E and governance. Additionally, there is need to design a simple accounting system and train the communities on its use.
ii. There is also need to prepare a simplified version of the Public Procurement and Disposals Act to fit the circumstances of small community based organizations.
iii. A lot of awareness creation must also be undertaken to ensure that people understand how the project has been planned, and how it will work with both national and county governments in implementing its mandate.
iv. Additionally, in funding projects within the Focal Development Areas and those under WRUAs and CFAs under the WSTF, conscious attention must be given to have some form of equity among counties and sub-counties, while at the same time promoting healthy competition among them. Areas which have traditionally been left behind development-wise like Tharaka Nithi County may also be given preference.
v. The project design was carried out before the implementation of the new constitution which has given rise to new structures which are still in their early stages. As such, there are challenges on the roles and functions of national and county government and how they inter-relate. The project must thus carefully engage with both the national and county government, maximizing on synergies at each level in order to ensure successful implementation of the planned project.
vi. The study recommends that the project should consider opening project accounts at the sub counties to minimize risks in handling project funds and save on time wasted traveling to and from county headquarters.
vii. The survey established that with only two (2) officers, the procuring unit is understaffed and there is need to add an officer in the unit to handle various aspects in the procurement such as procurement processing, receiving and issuing of goods works and services as provided for by section 26 of the Public Procurement and Disposal Act (2005).

1.0 INTRODUCTION

1.1 Upper Tana Natural Resources Management Project (UTaNRMP)

The Upper Tana Natural Resources Management Project is an eight year project (2012-2020) funded by Government of Kenya, International Fund for Agricultural Development (IFAD), Spanish Trust Fund and the Local community. The goal of the project is to "contribute to reduction of rural poverty in the Upper Tana river catchment". This goal is pursued via two development objectives which reflect the poverty-environment nexus namely (i) increased sustainable food production and incomes for poor rural households living in the project area; and (ii) sustainable management of natural resources for provision of environmental services. The thrust of the project is to empower the people to undertake community natural resources management.

The UTaNRMP is an up-scaling of the successfully implemented Mount Kenya East Pilot Project (MKEPP) for Natural Resource Management between years 2004 and 2012. MKEPP was implemented in five river basin of Ena, Kapingazi, Tungu, Kathita and Mutonga/Kithinu, and coved the districts of Meru, Meru South, Mbeere, Embuand Tharaka. It implemented activities targeting about 580,000 people in the five river basins, while the GEF-funded activities, implemented within the Mt. Kenya forest ecosystem that comprises the National Park and surrounding Forest Reserve, targeted about 800,000 people living within 10 km of the forest reserve boundary. The new project will also build on the implementation capacity already developed under the pilot MKEPP, and also address the major design and implementation gaps identified.

The rationale for UTaNRMP is based on the nexus between rural poverty and ecosystem health in a densely populated and environmentally fragile watershed of critical national and global significance. The high prevalence of rural poverty contributes to environmental degradation which in turn reduces sustainable livelihood opportunities; as well as creating negative environmental externalities including forest degradation, human-wildlife conflict, and reduced availability and quality of water to downstream users.

Fortunately however, there are a number of opportunities for improving rural livelihoods in ways that are also beneficial for the natural environment. Essentially the project will work with the custodians of natural resources in the Upper Tana catchment providing them with a number of direct and indirect incentives to undertake activities that are good for the environment, good for them, and from which other parties will also derive benefit.

The project area is the Upper Tana catchment which covers an area of 17,420 km^2 and includes 24 river basins and the tributaries of five river basins under MKEPP that drain into the Tana River. The area covers the six counties of Murang'a, Nyeri, Kirinyaga, Embu, Tharaka-Nithi and Meru and is home to 5.2 million people.

The upper tana catchment that provides water for about half the country'spopulation, and most of the country's hydroelectric power. The area includes the Mount Kenya and Aberdares National parks and surrounding forest reserves. The area is under heavy and growing population pressure with an average of about 250 inhabitants per km^2.

The UTaNRMP will undertake a phased approach in its interventions in the 24 river and tributaries of the five MKEPP river basins included in the project area, targeting 12 priority river basins and the tributaries of five MKEPP river basins in the initial phase based on a ranking of the river basins according to established environmental and social criteria. The five criteria used by the design team for this ranking are as follows:

i. Rivers that are over-utilized with high levels of water use inefficiencies.
ii. Rivers with significant pockets of environmental degradation.
iii. Rivers with the greatest risk of natural resources degradation.
iv. Rivers cutting across several agro-ecological zones.
v. Rivers having a large section of needy population.

Using these criteria, the project design team identified the 12 priority river basins to be targeted first, within which the project will select Focal Development Areas (FDAs), again based on degradation of natural resources, poverty levels and other social indicators.

Table 1.1: Rivers and Tributaries in UTANRMP

MKEPP River Basins (5) and their tributaries	**Ena** (Itimbogo,Thura, Gangara) **Kapingazi/Rupingazi**(Kiye,Thambana, Nyanjara,Gichangai,Itabua and Kathita), **Kathita**(Ngaciuma,Kinyaritha,Kuuru,Riiji) **Kithinu/Mutonga**(Naka,Nithi,Maara South,Maara North and Thuci) **Tungu** (none)
High Priority River Basins for UTaNRMP (12)	Maragua, Murubara, Nairobi, Ragati, Rujiweru, Rupingazi, Saba Saba, Thangatha, Thanantu, Thiba, Thika/Sasumua, Thingithu
12 Other river basins	Amboni/Muringato, Iraru, Kayahwe, lower Chania, Mara, Mariara, Mathioya, Nyamindi, Ruguti, Rwamuthambi, Sagana& Ura.

The project targets 205,000 poor rural households (1,025,000 people) whose livelihoods revolve around the use of the natural resources of the river basin. These include smallholder crop and livestock farmers, agro-pastoralists and pastoralists, fishers, rural traders, and community groups involved in Natural Resource Management (NRM) and income generating activities. The project will also have a special focus on community natural resources management, including common community areas like roads, riverbanks, schools, wetlands, hilltops and forests.

Special focus is being given to women and youth as well as other vulnerable groups within the above categories. The project will also provide indirect benefits to the non-target groups in the Upper Tana catchment through services and enterprises linked with the project activities, as well as to populations outside the catchment who rely on water and hydro-electricity from the river system.

The project has been structured along the same lines as MKEPP and will primarily focus on community natural resources management. The project has four components, each of which will generate its own outcome:

Table 1.2: Components of UTaNRMP

Component	Outcome
a) Community Empowerment	• Rural communities empowered for sustainable management of natural resources
b) Sustainable Rural Livelihoods	• Natural resource-based rural livelihoods sustainably improved
c) Sustainable Water and Natural Resource Management	• Land, water and forest resources sustainably managed for the benefit of the local people and the wider community
d) Project Management and Coordination	• Project effectively and efficiently managed

1.2 Objectives of Baseline Survey

The project commissioned the baseline survey inorder to establish the condition in the project area before the start of project implementation. The specifically, the survey will assist in:

i. Generating baseline information/data to assist in assessing the project area situation at the beginning of the project.
ii. Setting bench marks/indicators to inform the M&E function of the project and form a platform for assessing the impact of the project and other project surveys and
iii. Providing comprehensive information for planning and decision-making besides providing benchmarks against which programme interventions will be assessed and will be a reference point when organizing other surveys.

The baseline data was collected under six main thematic areas:

i. Socio-Economic
ii. Water ResourcesManagement
iii. EnvironmentalConservation
iv. Agricultural/Rural livelihoods
v. Community Empowerment
vi. Project Management and Coordination.

As a cross-cutting issue, the baseline survey also reviewed all project indicators and targets and updated the log frame indicators where necessary.

1.3Survey Coverage

The baseline survey initially focused on the tributaries of the five river basins covered under the UTaNRMP's predecessor, the Mount Kenya East Pilot Project (MKEPP) for Natural Resources Management and the 12 high priority river basins. This was later changed to cover the whole project area, including the low priority river basins. The overall area of coverage was thus:

a) MKEPP River Basins (5):

i. Ena (Gitimbogo, Thuura, Gangara)
ii. Kapingazi/Rupingazi (Kiye, Thambana, Nyanjara, Gichangai, Itabua and Kathita)
iii. Kathita (Ngaciuma, Kinyaritha, Kuuru, Riiji)
iv. Mutonga/Kithinu (Naka, Nithi, Maara South, Maara North and Thuci)
v. Tungu (none)

b) High Priority River Basins

Maragua, Murubara, Nairobi, Ragati, Rujirweru, Rupingazi, Saba Saba, Thangatha, Thanantu, Thiba, Thika/Sasumua, Thingithu

c) Other River Basins

Amboni/Muringato, Iraru, Kayahwe, Lower Chania, Mara, Mariara, Mathioya, Nyamindi, Ruguti, Rwamuthambi, Sagana, Ura

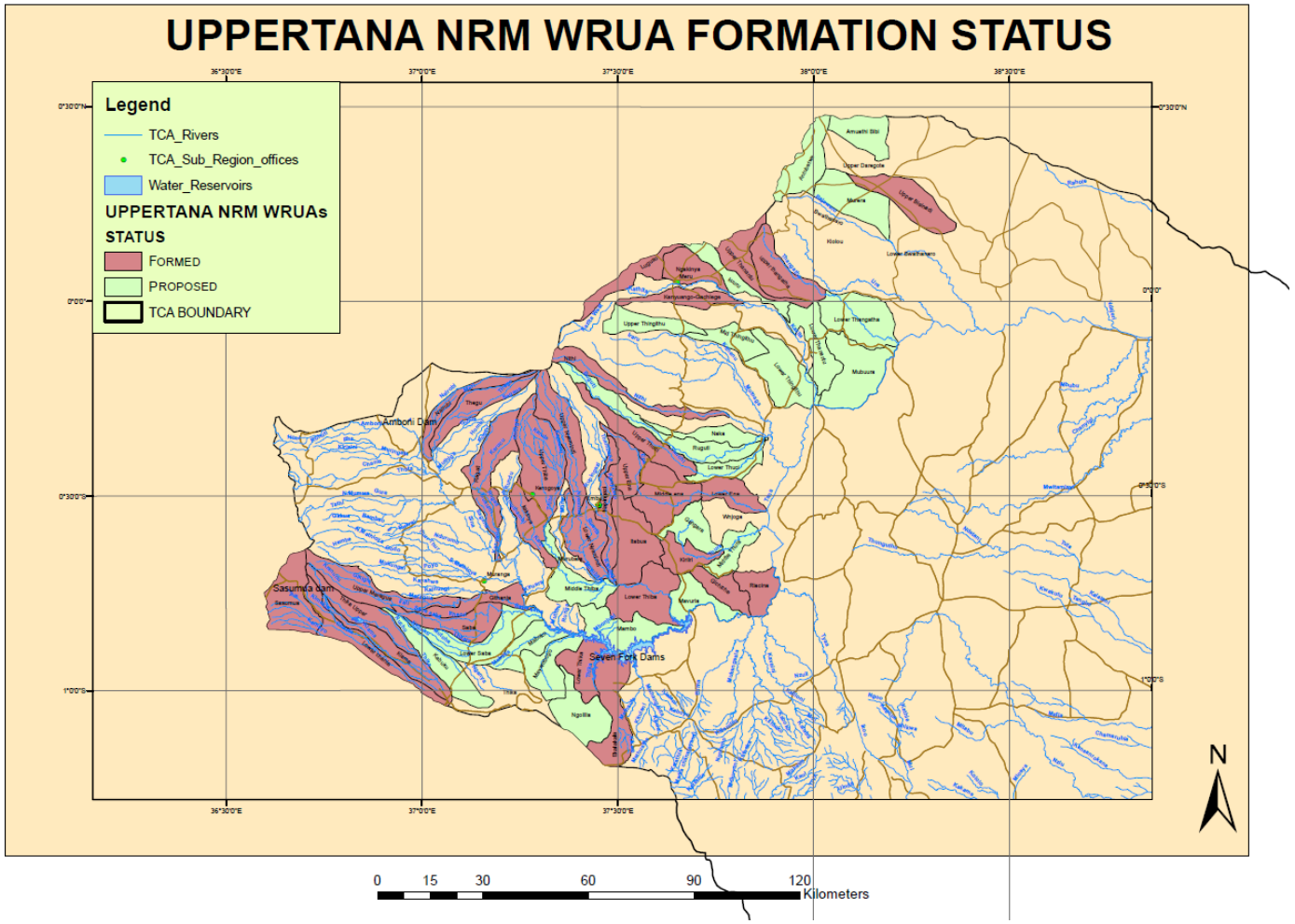


Plate 1.1: UTaNRMP WRUA Formation Status – February 2014

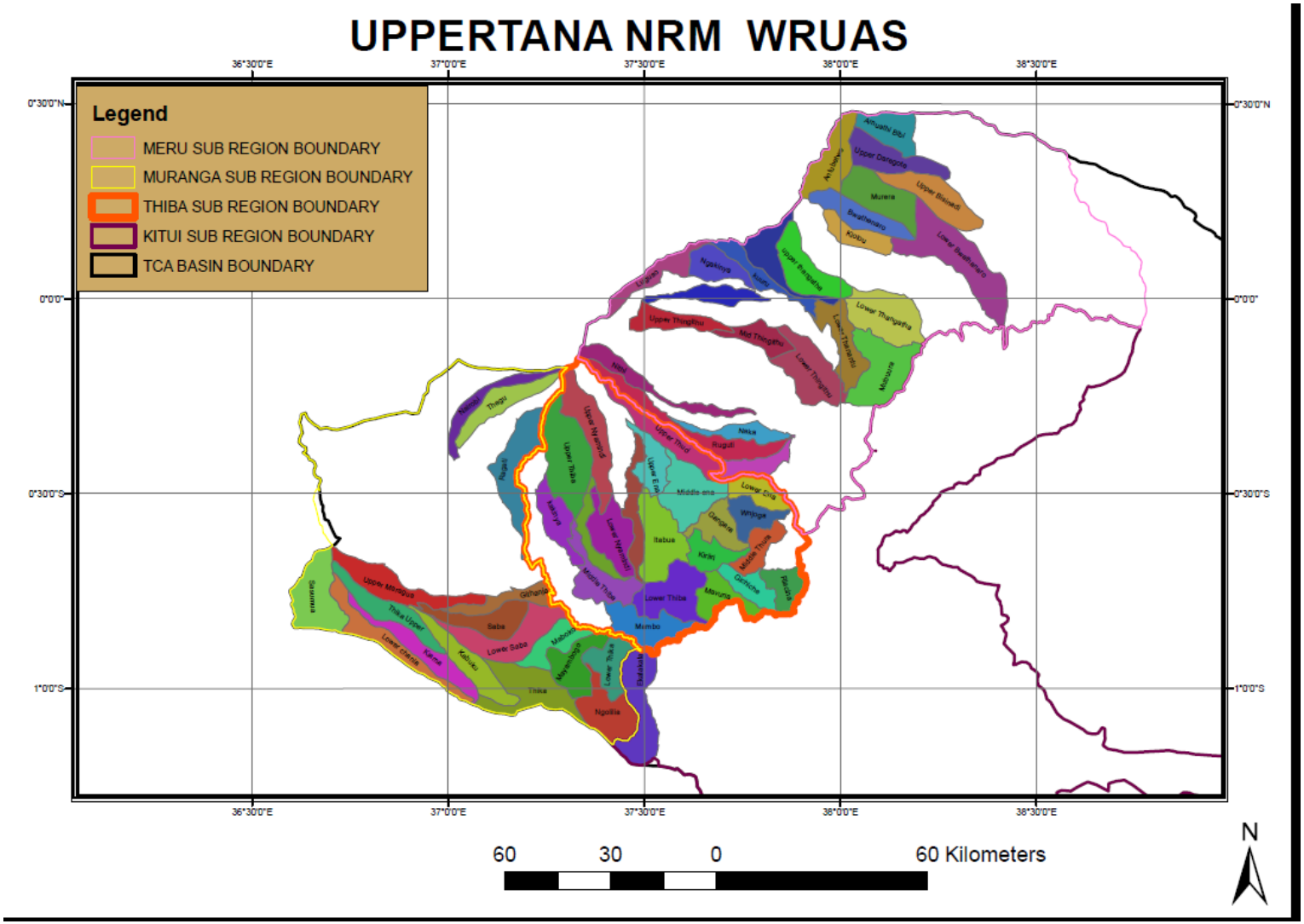


Plate 1.2: UTaNRMP WRUAs – February 2014

2.0APPROACH AND METHODOLOGY

2.1 Survey Approach

Overall, the survey approach focused on responding to the scope of work and activities given in the terms of reference. Generally, the approach consisted of the following: Discussions with the client to have a common understanding of the requirements of the survey; literature review to collect secondary data and to prepare checklists and tools to collect primary data; field visits to the river basins for household interviews, Key Informant Interviews, Focused Group Discussions, informal discussions, and observations; data entry and analysis, including reviewing of targets and log frames; and reports writing.

2.2 Discussions with the Client

The consultants' team maintained consultative discussions with the client over the entire period of the assignment. This was through several meeting wherein the inception report was presented; meeting to increase coverage of survey to include the 12 second level rivers basins, and meeting with other consultancy teams undertaking other related surveys for the UTaNRMP.

Like in other assignment already concluded by our firm, we shall also be available for occasional follow-up consultations and advice on any issues that may emerge during the project activity implementation as the client may request.

2.3 Mapping of River Basins

The consultant mapped/disaggregated the river basins and tributaries where baseline data was collected in order to get a good conceptual frame as to how the various areas would be covered in terms of data collection. SinceUTaNRMP would basically cover the areas covered by the Water Resource Users Associations (WRUAs) in the river basins, mapping also took into account the basin boundaries set out by existing WRUAS, and river basin areas where WRUA formation has been proposed by the Water Resources Management Authority (WRMA).

2.4 Collection of Secondary Data/Literature Review

This involved desk and literature review of documents received from the client and other publicly available data and literature. Some of the data, especially on socio-economic was collected from the six separate counties. The consultant has, where possible, disaggregated the information among the river basins. Some of the key literature reviewed included:

i. Project Design Report Vol. 1 & 2
ii. Strategic Environmental Assessment Report for the UTaNRMP
iii. MKEPP Baseline Survey Report, 2005

iv. MKEPP Completion Report, 2012
v. MKEPP Exit Strategy, 2012
vi. Natural Resources Management Project Completion Report, 2013
vii. County Integrated Development Plans
viii. National Water Master Plan 2030-By JICA – 2013
ix. Tana Catchment Area- Catchment Management Strategy, 2008.
x. Water Act-2002
xi. Forest Act 2005
xii. Wildlife Conservation and Management Act 2013
xiii. Relevant Policies: Water, Forestry, Climate Change
xiv. National Policy on Water Resources and Development-April, 29th 1999.
xv. The National Water Resources Management Strategy (2007-2009) - January, 2007.
xvi. The Water Resources Management Rules, 2007.
xvii. The Environmental Management and Co-ordination Act, 1999.
xviii. County Integrated Development Plans
xix. 2009 Kenya Population and Census Data
xx. State of Environment reports for Counties
xxi. Wetlands Atlas of Kenya
xxii. Sub-catchment Management Plans for WRUAs
xxiii. Participatory Forest Management Plans for CFAs
xxiv. Economic Survey 2014
xxv. Baseline Survey on Conflict Mapping and Profile, 2012.

Other documents reviewed are listed in the References at the end of this Report.

2.5 Preparation of Data Collection Tools

The consultant prepared four data collection instruments for the survey to capture the various quantitative and qualitative data per river basins and tributaries. These included:

i. a key informant interview guide
ii. a focused group discussion interview guide
iii. a household questionnaires
iv. an observation guide

The consultant held discussions with the client where the tools were reviewed and an agreement reached on the quality of the tools. The tools were then pre-tested on the 14th of March 2014 in the Lower Thika WRUA, and the necessary adjustments made. The data collection instruments are attached as Appendix 2 in this report.

2.6 Inception Report

The contract stipulated that an Inception Report be prepared within 14 days of commencing the assignment. This was prepared and elaborated on the work schedule and further detailed the methodology to be used. It also included the data collection instruments, and progress made especially as regards literature review and discussions with the client.

2.7 Sampling

Various sampling methods were used in the survey. For the household's survey, stratified random sampling was used, while for key informants purposive sampling was undertaken. For the focused groups discussions, both stratified random sampling and purposive sampling methods were used. Purposive sampling was used as it targeted persons who would offer specific information in the four target areas of socio-economic; water; environment, and livelihoods. For the Focused Group Discussion, purposive sampling was further used, based on availability and access, due to time constraints.

2.7.1 Household Survey

Sample size: To determine the overall sample size for the household survey, the formula used was:

$$n = \frac{Z^2 * (p) * (1-p)}{c^2}$$

Where:
Z = Z value (e.g. 1.96 for 95% confidence level)
p = percentage of picking a choice, expressed as decimal
(0.5 used for sample size needed)
c = confidence interval, expressed as decimal
(e.g., .04 = ±4)
Using a 95% confidence level, a 50% percentage of selecting a HH and a confidence level of ±5, the overall sample size calculated was

$$\frac{1.96^2 * 0.5 * (1 - 0.5)}{0.05^2} = 384$$

Dividing the sample size of 384 by the 16 river basins (12 priority rivers and 4 MKEPP rivers), gave a sample of 24 per river basin. However, to disaggregate the data per river basin, a minimum sample of 30 is required. However, considering that increasing the sample size usually decreases the margin of era, we decided to increase the sample size per river basin by 50%, taking a sample of 36 rather than 24, and bringing the total number of samples to 576.

We were then requested to include the 12 non-priority river basin in the survey. For these basins, we reverted back to the earlier sample size of 24, which was the actual sample size determined. This was due to time limitations, which however did not compromise the methodology as we used the actual determined sample size.

The sample size was informed by the fact that the non-priority rivers were all in the same catchment and in between the other priority river basins earlier sampled, and they were mostly smaller in size. Some areas already sampled under the priority river basins were thus representative of these non-priority basins. The total sample for the non-priority river basins was 288 bringing the total household sample to 864. The total number of households sampled for the survey per river basin is as indicated below:

Table 2.1: Sample Size per River Basin

River Basin	Sample Size
1. Maragua	36
2. Murubara	36
3. Nairobi	36
4. Ragati	36
5. Ruji weru	36
6. Rupingazi	36
7. Saba Saba	36
8. Thangatha	36
9. Thanantu	36
10. Thiba	36
11. Thika	36
12. Thingithu	36
13. Mutonga tributaries	36
14. Kathita tributaries	36
15. Kapingazi tributaries	36
16. Ena tributaries	36
17. Amboni/Muringato	24
18. Iraru	24
19. Kayahwe	24
20. Chania	24
21. Maara	24
22. Mariara	24
23. Mathioya	24
24. Nyamindi	24
25. Ruguti	24
26. Rwamuthambi	24
27. Sagana	24
28. Ura	24
29. Total	**864**

Stratified Random Sampling was used to select the households to be interviewed with the whole Upper Tana Basin being taken as the overall population.

The population was first stratified according to the 24 river basins and the tributaries of the 4 MKEPP Rivers with each river basin constituting the first strata. This represented the area covered by the existing and planned Water Resource Users Associations (WRUAs). For the MKEPP Rivers, the first strata constituted all the tributaries of the individual river.

Each river basin (first strata) was then divided into three sub-strata representing the upper, middle and lower sections of the river basin. As the population is not equally distributed along the river basin, with the upper and lower sections being less densely populated compared to the middle zone; the sample per river basin was divided in the ratio of 1:2:1 for the upper, middle, and lower sections of the river. As such, the priority river basins had a sample of 9:18:9 while the non-priority rivers had 6:12:6 households sampled for the upper, middle, and lower sections of the river basin.

In selecting the households for the survey, the survey team started at one end of the second tier strata where they would select 2 – 4 households randomly (2 for upper and lower, and 3 or 4 for the middle sections). They would then move about 2-3 kilometers and select another set of households. The same process would then be repeated as they moved towards the other end of the strata. This is as illustrated in the figure 2.1 below.

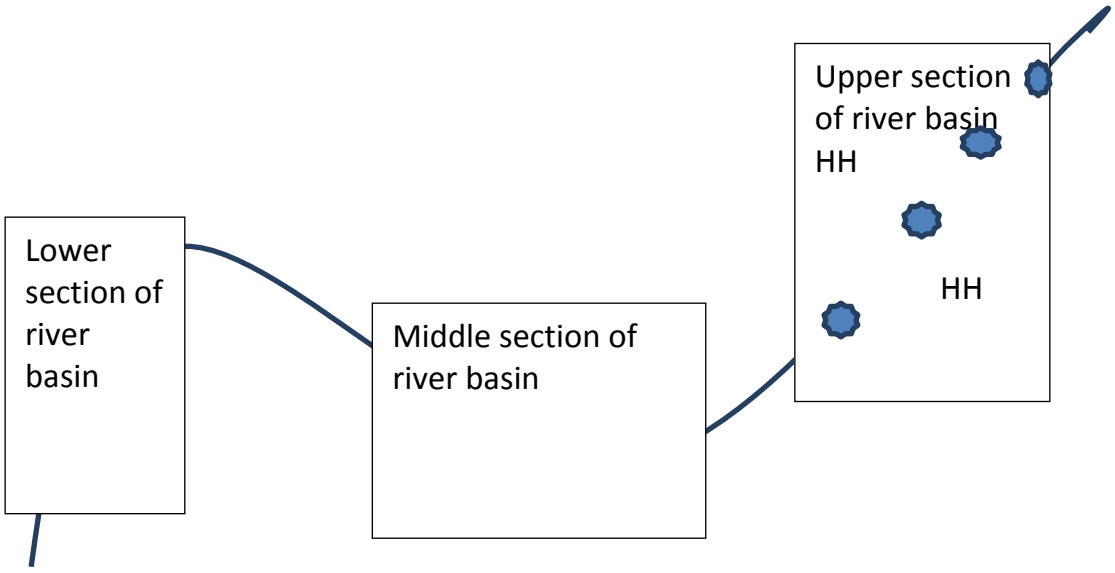


Figure 2.1: Sampling Procedure

The survey team was made up of a consultant and 3 or 4 local enumerators. The enumerators were all recruited locally in each of the second tier strata. They were first trained on how to administer the questionnaires. Thereafter, the enumerators administered the questionnaires as per

the sampling methods described. Overall, each enumerator administered 3 to 4 households per day.

Being a stratified random sample, replacement was undertaken by picking another household where household members were not present or were not ready to participate in the survey.As such, the survey sampled all 888 households envisaged.

2.7.2 Key Informant Interviews

The key informant interview guide targeted key Government departments and institutions. The informants were purposively selected at both county and sub-county level and included officers and officials from:

i. Ministry of Agriculture, Livestock and Fisheries
ii. Ministry of Environment, Water and Natural Resources
iii. Ministry of Labour, Social Security and Services – Social Development
iv. Kenya Forest Services (KFS)
v. Kenya Wildlife Services (KWS)
vi. Water Resource Management Authority (WRMA)
vii. Water and Sanitation Companies
viii. Ministry of Education, Science and Technology
ix. Ministry of Industrialization and Enterprise Development –Cooperative Department
x. National Environment Management Authority (NEMA)
xi. Ministry of Devolution and Planning (Planning and Gender Departments)
xii. Faith Based Organizations – Catholic, Methodist and Anglican church development offices
xiii. Umbrella organizations – poultry, breeders etc.

Unless where they were unavailable, officers from these institutions were interviewed in each of the counties. The survey mainly targeted officers who would provide information on the broad study areas of: socio-economic data; forestry, wildlife and environment data; water resources data, and rural livelihood/agriculture data. Overall 132 persons were interviewed during the survey and their names listed as Appendix 3.

2.7.3 Focused Group Discussions

The focused group discussion targeted Community Forest Associations (CFAs); Water Users Association (WUAs); Water Resource Users Association (WRUAs); Common Interest Groups (CIGs); Community Based Organization (CBOs) and Non-Governmental Organizations (NGOS) dealing with aspects of Natural Resources Management in the counties and river basins/tributaries.

Most of the river basins originate in the forest, where there is a CFA, while most of the WRUAs are divided into two or three sections, where we also targeted the WRUA committee

members. Overall, we were able to meet 14 WRUAs; 12 CFAs; 16 WUAs as per the table below, out of the initial overall target of 42 FGDs–14/71 WRUAs representing 20% of the registered WRUA population; 8/39 CFA representing about 20% of the registered CFA population; and 20/100 WUAs representing 20% of registered and non-registered WUAs/service providers.

Table 2.2: Names of WRUAs/WUAs and CFAs Met

No.	WRUAs	WUAs	CFAs
	Maragwa WRUA	Kirinyaga Water and Sewerage Company (KIRIWASCO) – Kerugoya	Wanjerere CFA
	Mugaka WRUA	Embu Water and Sewerage Company (EWASCO) – Embu	Zuti CFA
	Ngakinya WRUA – Ngaciuma basin	Meru Water and Sewerage Company (MEWASS) – Meru	Lower Imenti CFA
	Mariara WRUA	IMETHA Water Company – Meru	Njukiini CFA
	Ruarucka WRUA – Rwamuthambi	Muthambi WUA (4K Water Association) – South Maara	Castle CFA
	North Mathioya WRUA	Mwihoko water project – Rwamuthambi river	Hombe CFA
	South Mathioya WRUA	Kibaratani water project – Rwamuthambi river	Muringato CFA
	Kayahwe WRUA	Kithumbu Multipurpose irrigation project – Rwamuthambi river	Ragati CFA
	Ragati WRUA	Muthegi water project – Rwamuthambi river	MEFPEC CFA
	Rupingazi WRUA	Mwenderi Mugabaciura water project – Rupingazi	Kamulu(Kathita, Mucheene, Lugucu)
	Thingithu WRUA	Riakanau Water and Sanitation company – Lower thiba	MEFECAP (Meru Forest conservation and Protection Association
	Gakaki WRUA	Muthithi water project – Rujiweru	Ruthumbi
	Nithi WRUA	Muguandu water project – Rujiweru	
	Ruguti WRUA	Kanjo Phase 1 water project – Rujiweru	
		Magomano irrigation farmers' cooperative society – Maara river	

No.	WRUAs	WUAs	CFAs
		Munga Kiriani Multipurpose cooperative society - Maara river	

2.8 Field Visits

Field visits were conducted from 7thMarch 2014 to collect data from the households, focused groups, and key informants. This was done concurrently and the data collection instruments earlier prepared wereadministered.

Key informants and focused group discussions were undertaken by the consultant who at the same time made observations and also geo-referencing hotspots, wetlands, and other points of interest to the survey.

2.9 Data Entry, Editing and Analysis

Enumerators handed in the completed questionnaires to their supervisors who then checked the questionnaires for completeness and compliance to the administration manual. This was for quality control.

The questionnaires were then forwarded to consultants head office in Nairobi for computer data entry. Here, for further quality control, editing of raw data was further done to check for obvious errors without changing any variables. The data was then verified and validated before the tables were generated. All data was then analyzed qualitatively and quantitatively as necessary.

2.10 Report Writing

An inception report was initially submitted before commencement of the field visits. Thereafter a draft report was submitted to the client and presented in a validation workshop. Comments received from the client and the workshops were then incorporated into this final report.

GIS maps of hotspots are attached as separate annexes to this report.

3.0 PRESENTATION OF SURVEY FINDINGS AND RECOMMENDATIONS

3.1 SOCIO-ECONOMIC DATA

3.1.1Population Distribution and Structure

The Upper Tana Natural Resource Management Project (UTaNRMP) covers 6 counties namely Murang'a, Nyeri, Kirinyaga, Embu, Tharaka, and Meru. The total population in the six counties according to the 2009 Kenya Population Census results was 4, 402,036 people (KNBS, 2010). It was however estimated that the population had grown to 5.2 million people at project design. The project area has an average of 250 people per square kilometer compared to an average of 66 people per square kilometer in the country. This ranges from 138 people per square kilometre in Tharaka Nithi County to 368 people per square kilometer in Murang'a County. The national average population density is estimated at 66 people per square kilometer. This is shown in the table below.

Table 3.1: Population in the Project Area

County	Male Pop	Female Pop	Total Pop	Denstity - KM^2
Murang'a	457,864	484,717	942,581	368
Kirinyaga	260,630	267,424	528,054	357
Nyeri	339,725	353,833	693,558	208
Embu	254,303	261,909	516,212	183
Tharaka Nithi	178,451	186,879	365,330	138
Meru	670,656	685,645	1,356,301	196
Total	**2,161,629**	**2,240,407**	**4,402,036**	**National Average 66**

Source: 2009 Kenya Population and Census Data (KNBS, 2010)

An analysis of population projection shows that, across the counties the population of the labour force (aged 15-59 years) is 2,426,770 which forms the largest and is 55% of the total population. Youthful population (15-34) in the counties accounted for 34% of the entire population in the project area. Those above 60 years were estimated at 8% while children aged below 15 years accounted for 37% of the entire population in the project area as shown table 3.2.

The population projections based on the 2009 census figures shows that the population in the project target area will grow by about 11 percent by 2017 (table 3.3). This is significant given that growth in population also implies increased pressure on land.

Table 3.2: Population Structure

County	0-14			15-34			35-49			50-59			60+			TOTAL		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Murang'a	**168,181**	**173,684**	**341,865**	**153,452**	**155,425**	**302,524**	**65,708**	**75,746**	**141,454**	**27,517**	**32,140**	**59,657**	**39,893**	**50,835**	**90,728**	**454,751**	**487,830**	**942,581**
Kirinyaga	87,943	**87,168**	175,111	**93,988**	**96,389**	**190,377**	**46,291**	**45,781**	**92,072**	**15,164**	**15,345**	**30,509**	**17,244**	**22,741**	**39,985**	**260,630**	**267,424**	**528,054**
Nyeri	**118,796**	**115,467**	**234,263**	**117,195**	**119,632**	**236,827**	**56,142**	**60,850**	**116,992**	**19,372**	**22,123**	**41,495**	**28,220**	**35,761**	**63,981**	**339,725**	**353,833**	**693,558**
Embu	**97,481**	**96,354**	**193,835**	**88,364**	**89,645**	**178,009**	**37,803**	**40,230**	**78,033**	**14,070**	**14,994**	**29,064**	**16,585**	**20,686**	**37,271**	**254,303**	**261,909**	**516,212**
Tharaka Nithi	**71,960**	**71,026**	**142,986**	**58,431**	**63,630**	**122,061**	**24,720**	**26,304**	**51,024**	**10,634**	**10,930**	**21,564**	**12,706**	**14,989**	**27,695**	**178,451**	**186,879**	**365,330**
Meru	**272,441**	**269,258**	**541,699**	**232,917**	**246,333**	**479,250**	**90,671**	**90,049**	**180,720**	**34,551**	**34,234**	**68,785**	**40,076**	**45,771**	**85,847**	**670,656**	**685,645**	**1,356,301**
TOTAL	816,802	812,957	1,629,759	741,347	767,701	1,509,048	321,335	338,960	660,295	121,308	129,766	251,074	154,724	190,783	345,507	2,158,516	2,243,520	4,402,036

Source: 2009 Kenya population and housing census results / CIDPs

Table 3.3: County Population Projections

County	**2009 (Census)**			**2013(projections)**			**2015 (projections)**			**2017 (projections)**		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
Murang'a	457,864	484,717	942,581	461,984	490,326	947,530	462,724	496,245	958,969	466,441	500,231	**966,672**
Kirinyaga	260,630	267,424	528,054	272,626	279,733	552,359	285,175	292,608	577,783	293,860	301,520	**595,379**
Nyeri	339,725	353,833	693,558	346,311	360,692	707,003	349,651	364,172	713,823	353,024	367,684	**720,708**
Embu	254,303	261,909	516,212	268,952	276,995	545,947	276,586	284,860	561,446	284,441	292,949	**577,390**
Tharaka Nithi	178,451	186,879	365,330	188,351	197,247	385,601	198,800	208,190	406,996	206,090	215,825	**421,914**
Meru	670,656	685,645	1,356,301	715,378	728,177	1,443,555	761,400	775,022	1,536,422	793,715	807,915	**1,601,629**
TOTAL	**2,161,629**	**2,240,407**	**4,402,036**	**2,253,602**	**2,333,170**	**4,581,995**	**2,334,336**	**2,421,097**	**4,755,439**	**2,397,571**	**2,486,124**	**4,883,692**

Source: 2009 Kenya population and housing census results

Murang'a County is situated at the heart of the former Central Province. It measures 2,5591 square kilometers with a population of 942,5812. The County is dominated by the Kikuyu community, with migrant communities found in large scale farms in the Gatanga and Makuyu area. Nyeri County is located in the northern tip of Central Kenya. It measures 3,337 square kilometers with a population of 693,558. It is populated by the Kikuyu though other ethnic groups are to be found in the major commercial centres. Kirinyaga County is also situated in Central Kenya. It measures 1,479 square kilometers with a population of 528,054. The County is dominated by the Ndia and Gichugu sub tribes, though with minority Kamba, Embu, Meru, Mbeere and other communities residing mainly in the Mwea rice settlement scheme.

Embu County is situated at the centre of the former Eastern Province and covers 2,818 square kilometers with a population of 516,212 persons. The County is inhabited by the Embu, Mbeere, Kamba and Kikuyu communities and hence presents a cosmopolitan complexion. Tharaka-Nithi is located south of Meru County and occupies an area of 2,639 square kilometers with a population of 365,330 persons. The County is primarily occupied by Tharaka, Chuka, Muthambi and Mwimbi sub-tribes of the Meru. Finally Meru County is situated in the former Eastern province. It is known for its close proximity to the Mount Kenya with the Mount Kenya Forest covering a large section of the County. The County covers 6,936 square kilometers with a relatively high population of 1,356,301 people. The County is dominated by the Meru ethnic group, with mostly migrant communities constituting an insignificant minority.

3.1.2 Economic Activities[3] and Poverty Levels[4]

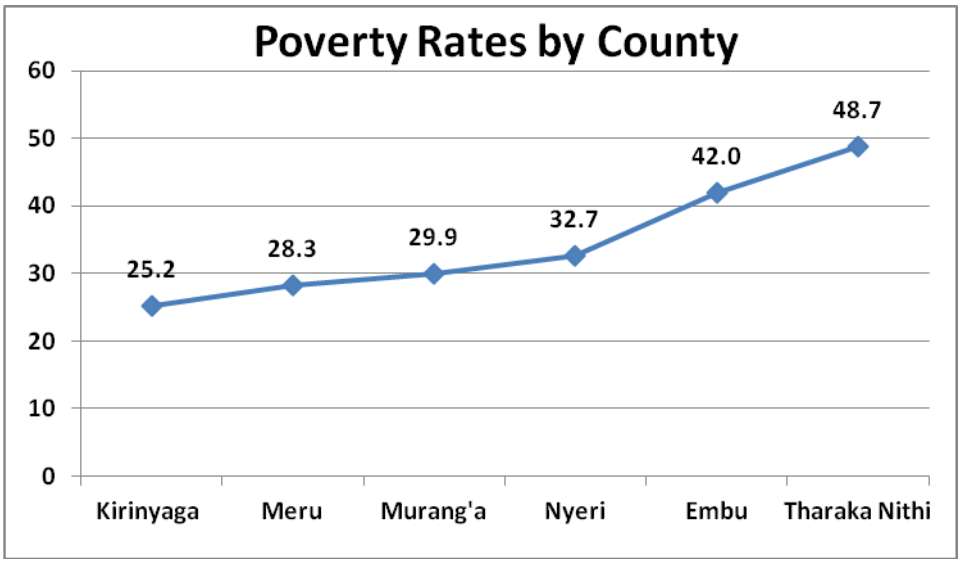
Murang'a County depends mainly on agriculture and dairy farming. The main cash crops are coffee and tea in the highlands and fruit trees such as oranges and mangoes in the low lands. Poverty levels in the county average 29.9 percent. The main economic activity in Nyeri County is agriculture and dairy farming in the highlands, with some quarrying in the lowlands parts of Kieni and tourism around the Aberdare and Mt Kenya forests. The poverty rates are relatively high at 32.7 percent. Kirinyaga depends mainly on irrigated rice and horticulture farming around Mwea on the lower parts of the county and tea, coffee and dairy farming in the highlands of the county. Poverty rates in the county are relatively lower at 25.2 percent.

Embu County also depends on agriculture, dairy farming livestock rearing. Coffee and tea are common in the highlands of the county while miraa (khat), maize, sorghum and green grams are grown on the lower parts of the county, Rice is grown through irrigation on the areas neighbouring Mwea. While the upper areas of the county practice dairy farming, pastoralism

[1] The area shown in this section is the administrative area. It excludes area covered by forests and water bodies
[2] Population figures drawn from the 2009 Kenya population and housing census
[3] Information on economic activities is from literature reviewed including, county Integrated development plans, former district development plans, reports by National drought management authority
[4] Poverty rates used are borrowed from the Commission for Revenue Allocation (2012), and are based on the Kenya Integrated Household Baseline Survey, KIHBS (2007)

is common in the lower areas of the county. The poverty rate in the county is at 42 percent. The upper slopes of Tharaka Nithi County have better climatic conditions and therefore support tea and coffee farming, whereas the low lying areas are arid and therefore support subsistence farming of cereal crops such as green grams, sorghum and pastoralism. Poverty rates in Tharaka Nithi are at high 48.7 percent and the highest in the project area. Finally Meru County is endowed with high potential arable land which supports, tea, coffee, and banana growing on a commercial basis in the highlands. The low lands feature cereals farming, and miraa (khat) production around Maua. Poverty levels are at 28.3 percent. The figure below shows the poverty levels across the different counties.

Figure 3.1: Poverty Levels by County



Source: Commission for Revenue Allocation data (December 2011)

The baseline survey did not seek to establish poverty rates across the river basins. However, perceptions about poverty were sought from respondents. Generally, respondents perceived the poor as people with low living standards, as needy while quite a number described poor people as lazy. Further discussions in the FGDs elaborated that people with low living standards are those that cannot afford three meals in a day, people whose children are malnourished and do not attend school, people without decent shelter, and clothing. When asked how poor people coped with their situation, the most common responses were through casual labour, begging and support from external sources such as relatives, and government. Those in casual labour often exchange their labour for food. Thesurvey findings suggest that, people in all river basins believe that poor people had a role to play in moving out of the situation they faced.

3.1.3 Household Size and Female Headed Households

Survey results show that average household size across all the river basins was estimated at 6 people per household. However, this ranged from about 5 people in Nairobi river basin to a

high of 8 people in Ragati basin. For the purposes of this survey, a household was defined as people who stay and live together, and have common arrangement for the preparation and consumption of food. Similarly, a person who lived alone was considered a household. Further, people who slept in separate rooms, but prepared food and ate together were also considered a household.

The survey results further show that Rujiweru/Bwathunaro led all the river basins with about 47 percent of all households headed by female. Rupingazi on the other hand had the least 8 percent of the households headed by female. On average 29 percent of all households in the river basins were headed by females. This information is shown in the table 3.4 below.

Table 3.4: Average Household size, Range of Household Size and Female Headed Households

River basin	Average H/H Size	Female Headed (%)	Household size Range
Nairobi	4.8	25	2-14
Rwamuthambi	6	31	3-20
Mariara	5	17	3-10
Sabasaba	5	44	2-18
Amboni	6	43	2-14
Ura	6	25	2-20
Nyamindi	5	25	3-12
Thika	5	30	1-11
Maragwa	6	27	1-18
Thangatha	6	31	2-10
Thiba	6	18	2-16
Mathioya	6	40	1-17
Ena tributaries	6	25	2-15
Maara	6	24	1-11
Thingithu	5	36	2-8
Murubara	7	38	2-18
Ragati	8	25	1-20
Rupingazi	6	8	2-11
Rujirweru/Bwathunaro	6	47	2-13
Mutonga tributaries	5	40	1-15
Thanantu	6	19	2-10
Muringato	5	30	1-12
Kathita tributaries	7	36	1-17
Kayahwe	6	25	2-9
Ruguti	5	24	2-14
Chania	6	27	2-12
AVERAGE	**5.8**	**29**	**1-18**

Source: Field data, 2014

In total, 17 river basins of those that were sampled had more than 5 household members. Similarly, 20 river basins had a quarter or more of their households headed by women, implying that there is a relatively high level of female headed households.

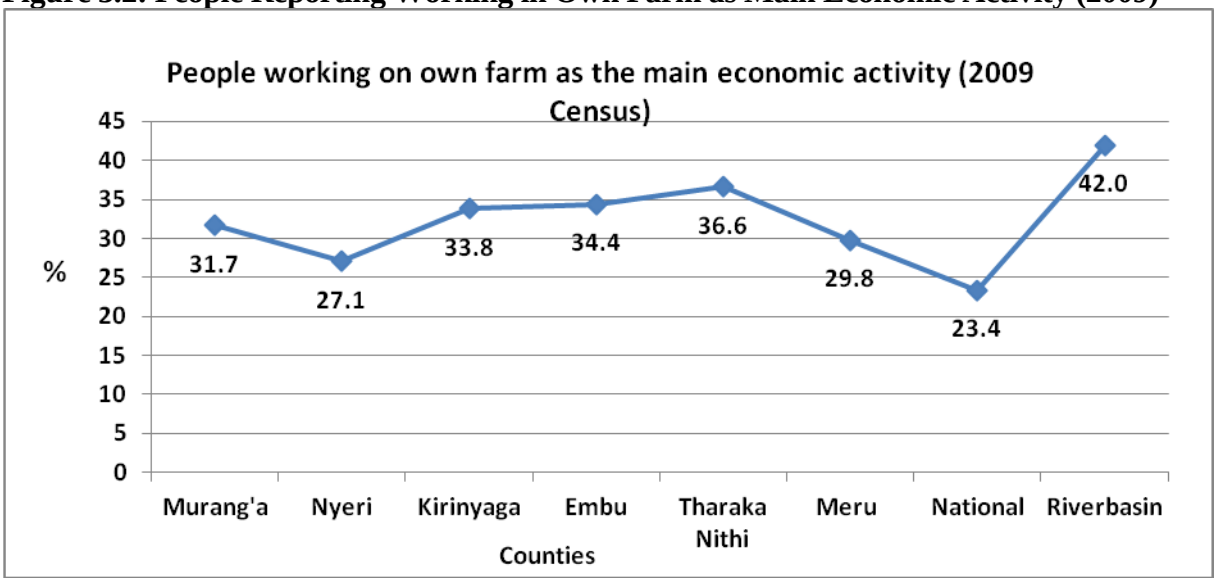
The survey shows that about 30 percent of households interviewed were headed by women. This could be as a result of death of the male spouse or the possibility that the male adult in the household work away from home. The implication for this project was that decisions on land use will have to be made by female, who may not be the actual owners of the land. Therefore, their level of decision making may also be limited. Interviews with key informants further revealed that some of the female heads of household may actually be women that have been dispossessed following the death of their spouses or after separation. This would imply that such women may not have rightful access to land. Some may be living on rented land and premises, while others may be squatters.

3.1.4 Sources of Household Incomes and Labour

The study also assessed the sources of incomes, average incomes and proportion of the household incomes. The findings show that households had their sources of income distributed across formal and informal employment sources. According to the survey results, most people had more than one source of income. Notably, people reporting self-employment could also have included those that worked on their own farms which would suggest an overlap in the findings. The survey results show that formal income sources ranged from 2 percent in Kayahwe to 45 percent in Maragwa. No one reported formal source in Sabasaba, Thingithu and Mutonga tributaries. This does not suggest that all people in these areas are not formally engaged, but it is an indication that very few of them are. Informal sources were reported in all river basins and these ranged from 4 percent in Mariara and Ragati respectively, to 67 percent in Maragwa.

People working in own farms were distributed across all river basins and this ranged from 10 percent in Mathioya and Kayahwe respectively to a high of 73 percent in Ena tributaries and Rujiweru/Bwathunaro respectively. Finally, self-employment was also reported across all river basins by about 8 percent of respondents in Rwamuthambi and Muringato respectively, to a high of 75 percent of respondents in Nairobi, Thanantu and Chania respectively. Census reports show that working own farms formed the largest single economic activity that was reported by people in the six counties during the 2009 population census. People were asked to state the main economic activity for the last 7 days preceding the census and results for the six counties are seen in figure 3.10 below. Other activities mentioned include, working for pay, on leave, own family business, internship, volunteer and seeking work.

Figure 3.2: People Reporting Working in Own Farm as Main Economic Activity (2009)



Source: 2009 Kenya Population and Census Data (2010)

As seen in the table below the average number of people who reported working in own farm as the main economic activity across all the river basins visited stood at 42 percent which compares reasonably well with the averages for the county. The county averages include people living in urban areas.

The average annual income was fairly uniform across all the river basins, ranging from Ksh10, 000 to KShs. 100,000 in 3 river basins, to a high of KShs. 1,000,000 in Rwamuthambi. Fourteen (14) river basins reported a maximum annual income of between KShs. 200,000-Ksh 300,000 while another seven (7) reported a maximum annual income of between KShs. 400,000-500,000.This is shown on the table 3.5 below.

Table 3.5: Sources of Income and Average Incomes by River Basin

River basin	Formal (%)	Informal (%)	Own farm (%)	Self-Employed (%)	Average incomes '000'	Proportion of sources[5]
Nairobi	15	8	37	75	50-100	Agri, 65% 40% casual labour
Rwamuthambi	12	62	15	8	10-1000	Agri 65%, casual labour 9%, other 26%
Mariara	43	4	48	43	10-100	Agri 100% , and casual labour 20%
Sabasaba	0	39	17	51	10-100	Agri 80% casual labour 14%
Amboni	26	13	39	83	10-500	Agri 83%, Casual labour 20% Formal employment 19%
Ura	8	29	71	33	10-300	Agri sales 80%, casual labour 20%
Nyamindi	16	8	67	33	10-300	Agri sales 85% Casual labour 25%
Thika	30	37	33	22	10-500	Casual labour40%, Agric sales 70%
Maragwa	45	67	34	69	10-200	Agriculture75%, casual labour40%
Thangatha	10	5	53	50	10-300	Agri sales87%, small scale

[5] Notably,farmers had more than one source of income

River basin	Formal (%)	Informal (%)	Own farm (%)	Self-Employed (%)	Average incomes '000'	Proportion of sources[5]
						business30%
Thiba	6	6	62	26	10-300	Agri produce sales 90% others 20%
Mathioya	2	17	10	37	10-300	Agri sales89%, casual labour40%
Ena tributaries	15	55	73	55	10-200	Agri sales90%, casual labour30%
Maara	12	34	57	39	10-300	Agri sales60%, casual labour50%
Thingithu	0	6	50	47	10-500	Agri sales78%, casual labour40%
Murubara	7	26	54	16	10-500	Agri sales79%, casual labour46%
Ragati	43	4	48	43	10-500	Agri 89% and casual labour 23%
Rupingazi	22	43	48	62	10-300	Agri 73%, Formal employment 11%
Rujirweru/ Bwathunaro	8	39	73	33	10-200	Agri sales89%, casual labour30%
Mutonga tributaries	0	39	17	51	10-400	Agri 70% casual labour 24%
Thanantu	15	8	37	75	10-200	Agri, 74%, 24% casual labour
Muringato	8	62	15	8	10-400	Agri 64%, casual 34% other 16%
Kathita tributaries	30	37	33	22	10-200	Agri sales92%, casual labour20%,
Kayahwe	2	17	10	37	10-300	Agri sales90%,
Ruguti	15	30	56	30	10-100	Agri sales88%, casual labour27%
Chania	15	8	37	75	10-200	Agri80%; casual labou40%
AVERAGE	**16**	**27**	**42**	**43**	**10-320**	

Source: Field data 2014

The average income across the river basins ranged from Kshs. 10,000- Kshs. 320,000 per year (Kshs. Kshs 833-Kshs. 26,667 per month). This implies that the lowest categories of the beneficiaries are earning US$ 9.8 per month translating to US$ 0.33 per day. These are poor people which the project should target in the implementation of project activities.

On how the household incomes are utilised, respondents across the river basins reported that much of their income went to school fees, farm inputs and to domestic needs in that order.

87 percent of respondents across all river basins reported that parents/adults were involved in farm labour. This was for example mentioned by 100% of respondents in Murubara, Kayahwe and Ruguti. 67 percent of respondents in Thika basin reported that parents were the main sources of farm labour. Children were active participants in the farm as well. They were reported to be involved by 25 percent of all respondents.

At the river basin level, children were mentioned by 47 percent of respondents as a source of labour in Ura, suggesting that the river basin had the highest number of children involved in farm labour, while Thika had the least, as mentioned by 7 percent of respondents. 7 percent had permanent hired labour. This category was more common in Mathioya as mentioned by 35 percent of respondents and least common in Mariara, Ura, Thangatha, Ena Tributaries, Ragati and Chania where this category was not reported. Temporary hired labour was however common in all areas, especially in Rupingazi with 52 percent. This was least common in Mathioya as reported by 11 percent. Special focus will need to be paid to areas

with high numbers of hired labour. This is because people producing on the land are not the owners of the land.

The survey further sought to establish if farmers used mechanised farming on their lands. The findings show that tractors, sprays and irrigation pumps were the most common forms of mechanisation in use in the river basins. Tractors were used by just about 3 percent of the respondents, sprays by 13 percent and irrigation pumps by 14 percent of the respondents. Tractors were more common in Thanantu as mentioned by 11 percent. Sprays were more common in Rujiweru/Bwathunaro as reported by 49 percent of the respondents while irrigation pumps were more common in Thiba as reported by 40 percent of the respondents. These results are summarised in table 3.6 below.

Table 3.6: Types of Farm Labour and Machinery Used by River Basin (percentage)

River basin	Parents	Children	Permanent hired	Temporary hired	Tractors	Spray pumps	Irrigation Pumps
Nairobi	83	20	4	38	11	6	38
Rwamuthambi	77	12	12	27	12	0	4
Mariara	96	17	0	22	4	0	9
Sabasaba	73	39	5	39	0	2	8
Amboni	96	9	9	52	0	17	17
Ura	96	47	0	21	0	29	13
Nyamindi	92	8	8	33	0	8	8
Thika	67	7	7	26	4	15	11
Maragwa	85	20	6	38	0	23	23
Thangatha	78	25	0	43	0	0	0
Thiba	94	30	8	18	8	10	40
Mathioya	78	13	35	11	0	5	8
Ena tributaries	93	35	0	14	0	11	0
Maara	86	27	3	19	0	23	16
Thingithu	97	18	7	23	0	17	16
Murubara	100	33	6	18	9	0	21
Ragati	94	17	0	22	4	0	9
Rupingazi	86	19	9	52	0	17	17
Rujirweru/Bwathunaro	90	44	6	21	0	49	13
Mutonga tributaries	78	36	5	39	0	2	8
Thanantu	83	20	4	38	11	6	38
Muringato	84	12	12	27	0	0	4
Kathita tributaries	67	17	3	26	4	0	21
Kayahwe	100	35	17	24	0	8	0
Ruguti	100	54	7	23	5	40	5
Chania	89	36	9	40	6	50	17
AVERAGE	**87**	**25**	**7**	**29**	**3**	**13**	**14**

Source: Field data 2014

3.1.5 Type of housing, Sources of water, Light and Cooking Energy

HousingTypes

Housing types were assessed along three categories, namely permanent, semi-permanent and temporary. In the survey, permanent houses were seen as those whose main material was stones. Semi-permanent houses were defined as those whose main material was timber, while temporary houses were defined as those made of mud, iron sheets, or other material other than stones and wood. Notably, in parts of Embu and Meru and other cold upper regions of the catchments, people tended to combine stones and wood, in efforts to keep houses warm as wood retains warmth. In such cases the main material used for the construction of the house was used to define the house.

The results on the type of housing show that 47% of respondents have semi-permanent houses while 40% have permanent houses. This means that 87% of all respondents had either permanent or semi-permanent type of houses. About 11 % of all respondents had temporary houses. Across the river basins, permanent houses were more common in Thika basin as mentioned by 67 % of respondents and least common in Maara river basin as mentioned by 7 % of respondents. Semi-permanent houses were more common in Ura as mentioned by 84 % of respondents and least common in Kayahwe, where they were mentioned by 16 % of respondents.

People reporting temporary houses were relatively fewer, compared to other types but these were more reported in Thangatha by 26 % and least reported in Maragwa by just about 3 % of respondents. In total 9 river basins had more than half of the respondents reporting that they lived in permanent houses, compared to 11 which had more than half the people living in semi-permanent houses. Only one river basin (Thangatha) has about a quarter of respondents reporting that they lived in temporary houses. This implies that people had made significant investments in their houses, implying that they planned to live where they were for long, which implies that they were also more likely to invest more on their lands.

Sources of Water

The survey also explored the main sources of water across the river basins. From the results, on average, 59 percent of all respondents used piped water while 14 percent used rivers as their main sources. Piped water was more common in Nyamindi as reported by 92 percent of respondents, though the percentages across the river basins were relatively high. Piped water was least common in Thingithu as reported by 15 percent of respondents. The river as the main sources was more common in Thiba as reported by 82 percent of the respondents. It was however least common in Kayahwe and Nyamindi as reported by 8 percent of respondents.

The survey further established that the households with access to piped water does not mean that the water is piped to the households; they could be assessing it from a water kiosk.

Overall, people covered an average of 1.5 kilometers to the nearest water source. People in Thingithu and Ruguti however covered the longest distances estimated at about 8.6 kilometers to the nearest source. Those in Muringato covered the shortest distances estimated at about 0.25 kilometers to the nearest water source.

Sources of Lighting and cooking fuel

Kerosene was the most common source of lighting fuel for respondents across all the river basins as mentioned by about 68 percent of respondents. This was followed by electricity reported by 21 percent and solar by 8 percent and biogas by just about 3 percent of the respondents. Kerosene was common in all the river basins but it was more mentioned in Sabasaba and Mutonga basins at 95 per cent and least mentioned in Nairobi and Thanantu by 42 percent. Electricity was more reported in Nairobi and Thanantu at 57 per cent and least common in Ruguti as mentioned by 5 percent. Electricity was not mentioned as a source of light in this survey in Mutonga tributaries, Thingithu, Maara, Ura, Sabasaba and Rwamuthambi river basins. Solar energy was mentioned more in Maara by 43 percent of respondents and least in Mutonga tributaries and Sabasaba river basins as mentioned by 2 percent respectively. Solar was not mentioned in Thika Ragati and Kayahwe river basins. Biogas on the other hand was only reported by 42 percent in Rwamuthambi and 2 percent of respondents in Nairobi and Thanantu river basins.

Further, firewood and charcoal were the main sources of cooking fuel mentioned in the river basins. Firewood was the main source for 86 percent of the respondents while charcoal was the main sources for 8 percent. Firewood was mentioned more in Rwamuthambi, Sabasaba, Mathioya, Maara, Ragati, Kayahwe and Mutonga tributaries where all respondents mentioned it and least mentioned in Ruguti by 50 percent of respondents. Charcoal on the other hand was more common in Ruguti as mentioned by 45 percent respondents and least common in Mariara as mentioned by 4 percent respondents. While firewood was mentioned as a source of cooking fuel in all river basins, charcoal was not mentioned as a source in 16 river basins namely, Rwamuthambi, Sabasaba, Amboni, Nyamindi, Thika, Maragua, Ena tributaries, Maara, Thingithu, Murubara, Ragati, Rupingazi, Rujiweru/Bwathunaro, Mutonga tributaries, Ngaciuma and Kayahwe. These are summarised in the table 3.7 below.

The use of firewood and charcoal as a source of cooking fuel provides an opportunity to the project to develop new energy saving technologies which can be adopted by the beneficiary communities.

Table 3.7: Type of Housing, Sources of Water, Lighting and Cooking Energy by River Basin (percentage)

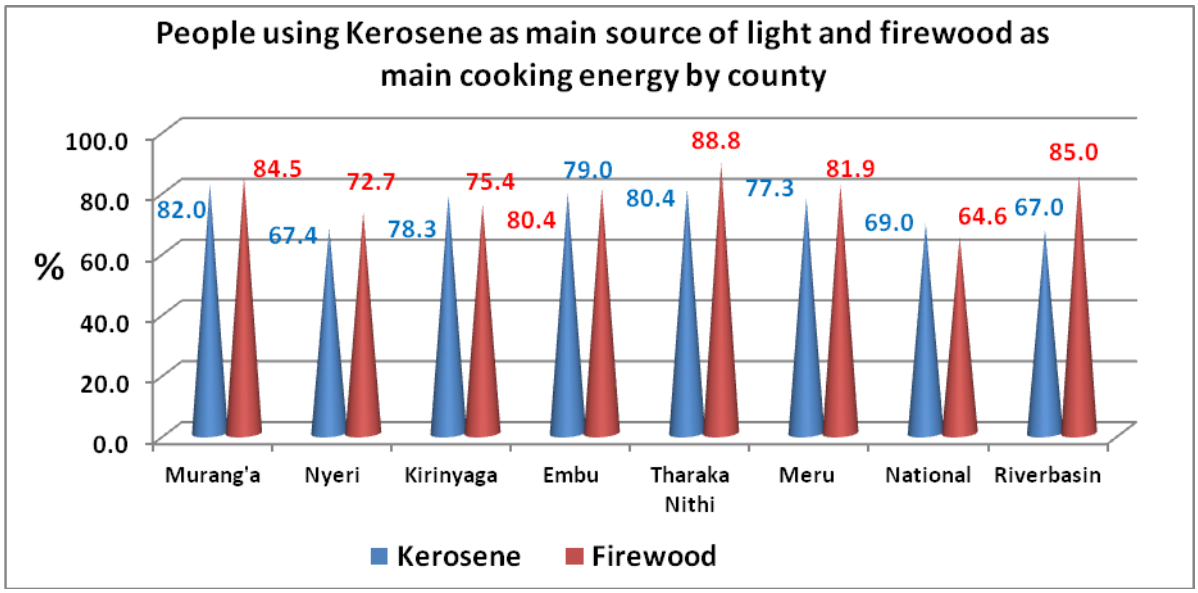
River basin	Housing type			Water Source and Distance to Source			Source of Lighting fuel				Source of cooking fuel	
	Permanent	Semi-permanent	Temporary	Piped water	River water	Distance	Kerosene	Electricity	Biogas	Solar	Firewood	Charcoal
Nairobi	51	42	7	89	11	0.7	42	57	2	8	85	15
Rwamuthambi	36	80	20	58	27	0.5	46	0	42	4	100	0
Mariara	48	43	9	87	13	2.0	48	30	0	9	96	4
Sabasaba	41	32	7	22	37	0.6	95	0	0	2	100	0
Amboni	52	43	4	52	48	1.0	61	30	0	7	65	0
Ura	8	84	8	79	16	0.28	83	0	0	8	83	8
Nyamindi	50	42	8	92	8	0.3	50	42	0	8	67	0
Thika/ Sasumua	67	19	15	63	33	0.7	48	52	0	0	70	0
Maragwa	36	55	3	39	61	2.1	61	18	0	12	78	0
Thangatha	15	56	26	65	35	1.0	77	18	0	8	95	0
Thiba	52	33	15	18	82	0.7	72	6	0	22	96	0
Mathioya	63	27	10	50	43	1.0	75	22	0	3	100	0
Ena Tributaries	57	37	7	50	32,	0.7	77	11	0	11	62	38
Maara	7	76	8	80	20	0.3	64	0	0	43	100	21
Thingithu	20	68	12	15	78	8.6	85	0	0	15	94	6
Murubara	25	65	10	32	65,	0.6	74	13	0	9	94	0
Ragati	38	53	9	67	33	2.5	48	42	0	0	100	0
Rupingazi	42	33	16	65	38	0.7	69	12	0	4	75	0
Rujiweru/Bwathunaro	28	64	8	45	55	0.31	73	27	0	8	97	0
Mutonga tri	41	32	10	22	37	0.6	95	0	0	2	100	0
Thanantu	31	62	7	89	11	0.7	42	57	2	8	85	15
Muringato	45	34	21	76	24	0.25	60	32	0	8	60	40
Kathita tri	57	33	10	83	17	0.7	67	34	0	8	97	0
Kayahwe	63	16	8	60	8	1.0	92	8	0	0	100	0
Ruguti	29	53	12	78	10	8.6	90	5	0	5	50	45
Chania	38	35	23	69	8	1.5	50	35	0	12	65	27
AVERAGE	**40**	**47**	**11**	**59**	**31**	**1.46**	**67**	**21**	**2**	**9**	**85**	**8**

Source: Field data, 2014

County level results from the 2009 census mirror these findings. The results show that Kerosene was the main source of lighting fuel across all counties ranging from 67.4 percent in Nyeri to 82 percent in Murang'a. The national average was 69 percent. Similarly, firewood was the most used source of cooking energy in the six counties ranging from 72.7percent in Nyeri to 88.8 percent in Tharaka Nithi. The national average was 64.6 percent. These county level results are seen in figure 3.3 below.

The river basin average consumption of kerosene at 67 percent mirror the national average of 69 percent. The results further show that use of firewood as the main source of cooking energy across the counties is similar to the river-basin average of 85 percent. These are however higher than the national firewood usage which was at 64.6 according to 2009 census results.

Figure 3.3: People Using Kerosene as the Main Lighting Fuel and Firewood as Main Source of Cooking Energy by County (2009)



Source: 2009 Kenya Population and Census Data (2010)

3.1.6Asset Ownership

Motor bikes, cars, water tanks, TVs, Radios, bicycles, mobile phones gas cookers, gas cylinders, and solar panels were some of the assets which people owned across the river basins. Mobile phones led in the list of most common assets as mentioned by 82 percent of the respondents. This was followed by the radio mentioned by 73 percent of the respondents. Television sets and water tanks were mentioned by 42 percent and 41 percent respectively, while bicycles were mentioned by 36 percent of the respondents. Others were motorbikes (14 percent), motor vehicles and gas cookers (11 percent respectively) solar panel (9 percent) and gas cylinder (7 percent). Ownership of these assets is presented in table 3.8 below. Notably, mobile phones were mentioned by all the people in Nyamindi and least mentioned in Thika at 74%.

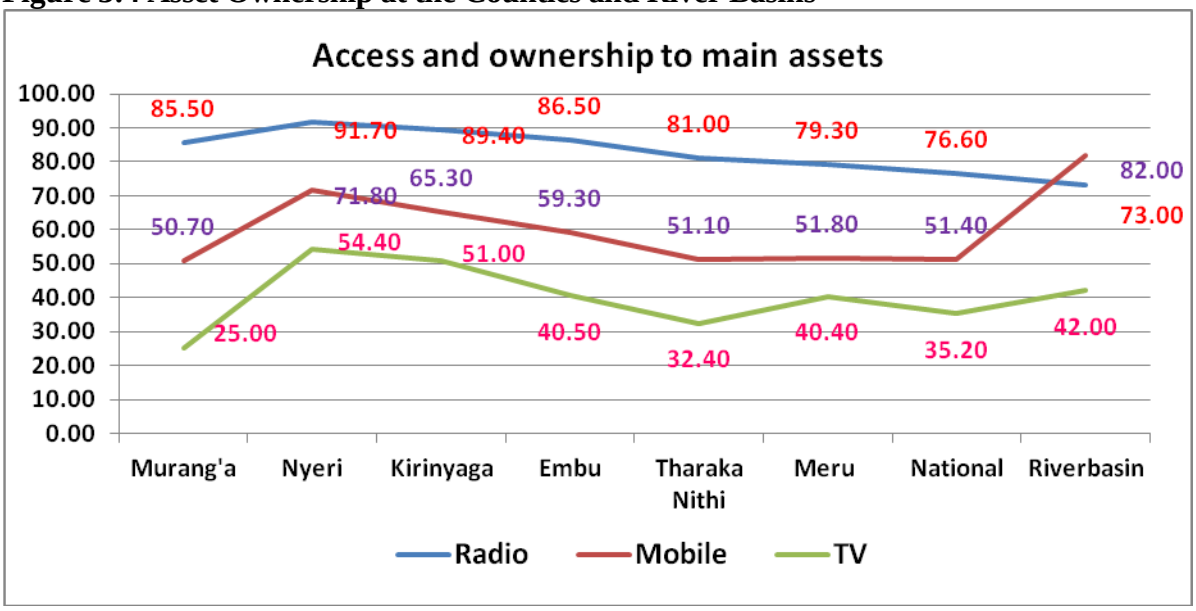
Table 3.8: Assets Owned by Households by River Basin (percentage)

River basin	Motor bikes	Motor Vehicle	Water tanks	Television sets	Radio	Bicycle	Mobile phones	Gas cookers	Gas cylinder	Solar panel
Nairobi	17	11	51	71	82	62	78	15	18	8
Rwamuthambi	3.4	19	35	46	81	38.5	77	15.4	3.4	3.4
Mariara	17	4	26	57	65	52	78	17	0	9
Sabasaba	5	2	54	12	80	24	80	2	0	12
Amboni	22	39	74	70	87	43	83	30	26	43
Ura	4	0	4	21	75	0	83	0	0	4
Nyamindi	8	16	67	58	83	42	100	33	25	16
Thika	7	11	33	48	63	30	74	33	7	0
Maragwa	6	64	4	3	76	56	87	3	3	0
Thangatha	10	18	13	26	82	15	92	0	0	0
Thiba	20	6	20	20	36	23	82	8	4	14
Mathioya	10	5	43	22	67	35	79	5	5	3
Ena Tributaries	12	8	67	23	75	38	84	2	2	8
Maara	6	4	52	59	87	55	84	6	0	13
Thingithu	24	5	47	53	69	39	79	0	0	3
Murubara	27	4	56	42	63	46	83	3	2	7
Ragati	17	4	49	57	65	52	78	17	0	9
Rupingazi	32	9	64	60	83	25	82	12	12	4
Rujiweru/Bwathunaro	4	3	4	21	65	0	82	0	0	4
Mutonga tributaries	5	3	54	12	84	24	80	2	0	12
Thanantu	27	11	51	68	72	32	78	12	9	11
Muringato	0	0	45	53	81	33	88	12	9	12
Kathita tributaries	5	11	45	48	63	32	83	33	7	0
Kayahwe	16	8	0	22	67	35	84	5	16	0
Ruguti	44	5	47	46	69	39	86	15	20	20
Chania	23	8	50	71	82	62	77	0	12	12
AVERAGE	14	11	41	42	73	36	82	11	7	9

Source: Field data 2014

County level analysis was reviewed on access to radio, mobile phone and television sets. The results indicate that people that had access to the radio ranged from 79.3 percent in Meru to 91.7 percent in Nyeri while the national average was lower at 76.6 percent. This compares well with the average ownership of the radio across the river basins which stood at 73 percent. Access to mobile phones across the six counties ranged from 50.7 percent in Murang'a to 71.8 percent in Nyeri while the national average was 51.4 percent. Ownership of mobile phones was however high across the river basins at an average of 82 percent, which portrays a high level of ownership compared to the national average access. In relation to the TV, access ranged from 25 percent in Murang'a to 54.4 percent in Nyeri. The national average was 35.2 percent while ownership across the river basins averaged 42 percent. These results are seen in figure 3.4 below.

Figure 3:4 Asset Ownership at the Counties and River Basins



Source: 2009 Kenya Population and Census Data (2010) and field data

3.1.7 Human Development Index[6] and Life Expectancy[7]

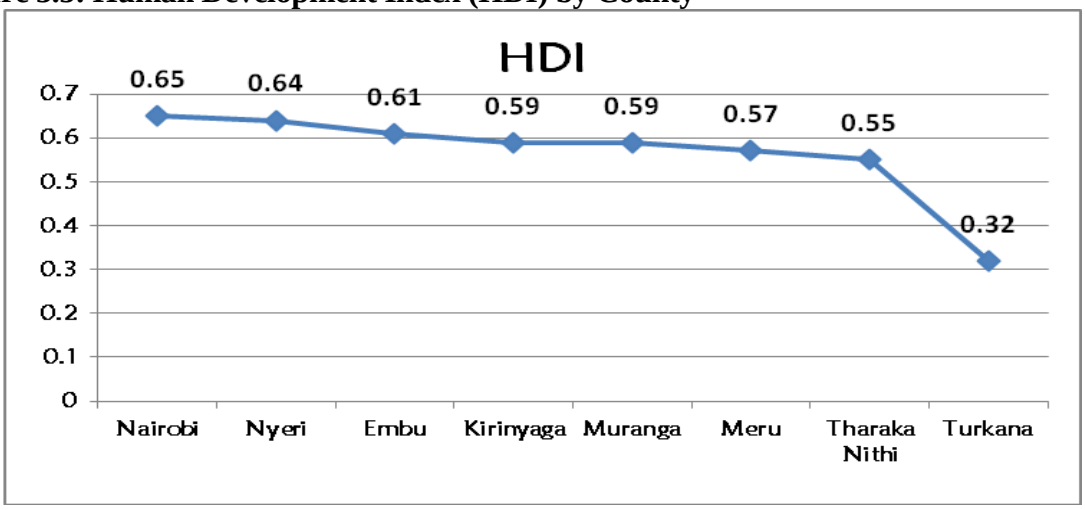
The Human Development Index (HDI) across the six counties ranges from 0.55 in Tharaka Nithi County, to about 0.64 in Nyeri County. This strongly mirrored the national averages considering that Nairobi County had the highest HDI of about 0.65, while Turkana had the lowest HDI of about 0.328. These estimates are shown in the figure below. The average for the country is estimated at about 0.56. Additionally, life expectancy at birth ranged from about 58.7 years in Tharaka Nithi County to 64.6 years in Embu County. Nationally, Bomet led all other counties with a life expectancy at birth of about 66.1 years while Homabay has the least at 39.8 years. This is shown in figure 3.5 below. The life expectancy in the six counties is above the national average estimated at 56.6 years.

[6]Human Development Index is a composite index measuring the average achievement in three basic dimensions of human development namely a long and healthy life, knowledge and decent standard of living, One (1) is a very high human development index

[7] Life expectancy is the number of years an infant born child could expect to live if prevailing patterns of age specific mortality rates at the time of birth stay the same throughout the infant's life

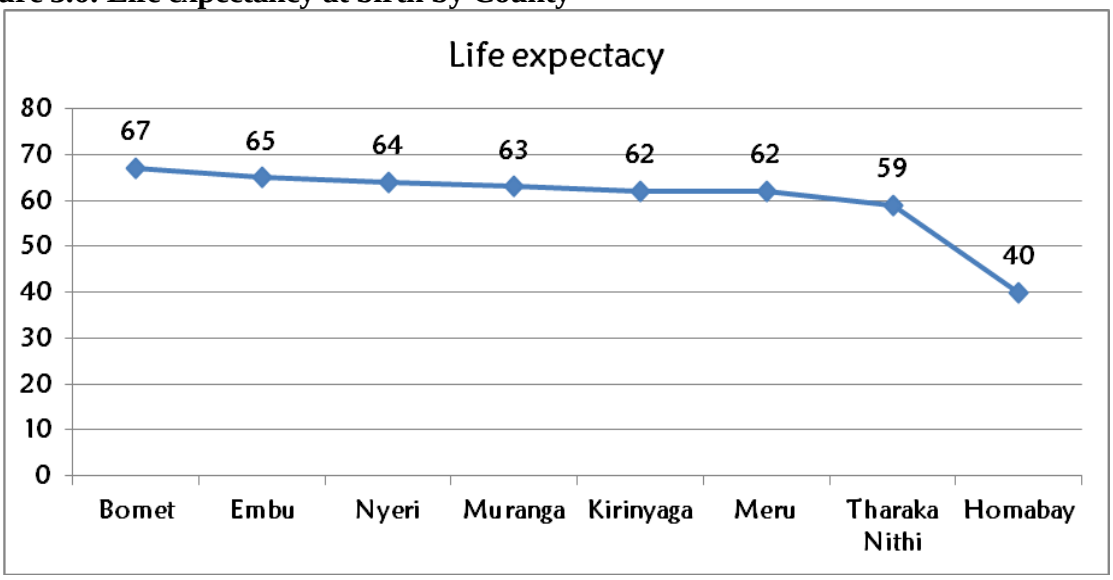
[8] Kenya Economic Survey 2014

Figure 3.5: Human Development Index (HDI) by County



Source: Kenya Economic Survey 2014

Figure 3.6: Life expectancy at birth by County



Source: Kenya Economic Survey 2014

While specific data on HDI and life expectancy was not collected during the baseline, interviews with stakeholders' confirmed the trends in the two indicators. Across the river basins, the above indicators vary, with higher Human Development Indices and longer life expectancy expected in the upper and middle zones which have more favourable climatic conditions for crop production and therefore better food security, compared to populations in the lower zones. So, for example, while Nyeri on average posts a high HDI, river basins on the lower parts of the county have lower indices. This trend cut across all the other counties.

3.1.8 Education Indicators and Literacy Levels

Education is a key development indicator. It is therefore important to review and explore education status and indicators in the counties and across the river basins. The Kenya Economic Survey 2013 shows that net enrolment rates across Early Childhood Development

(ECD), primary and secondary assume patterns that are interesting to this project. Enrolment in ECD was below 50 percent for all counties except Nyeri which registered an average of 61.8 percent in 2009. It was least in Embu with an average of 32.8 percent. At primary level, enrolment shoots to an average of 85 percent in Meru and 93.4 percent in Murang'a, before falling again at secondary level to lows of 22.3 percent in Meru and 46.3 percent in Nyeri. This implies that many children do not go through ECD as well as secondary school, as shown in the table below.

The national enrolment rates stood at 41.8 percent for ECDE, 91.4 percent for Primary and 24 percent for secondary9. The net enrolment rates in 2012 were reported to be 53 percent for ECDE, 95.3 percent for primary level and to 33.1 percent in at secondary level10.

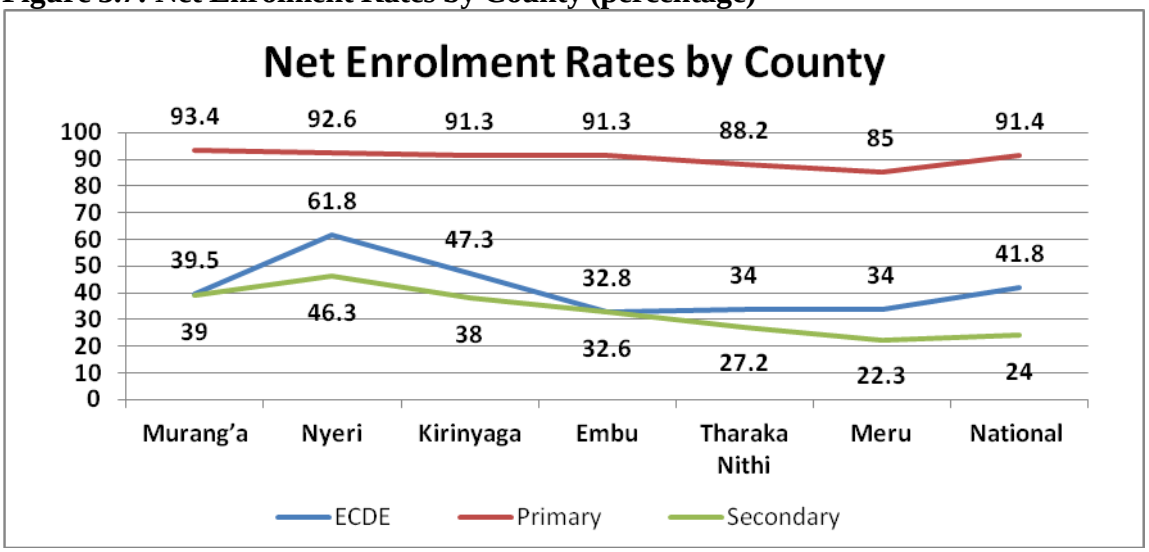
Table 3.9: Net Enrolment Rate by Level and by County in 2009

	ECDE			Primary			Secondary		
County	Male	Female	Total	Male	Female	Total	Male	Female	Total
Murang'a	39.3	39.8	39.5	93.2	93.7	93.4	36.0	42.1	39.0
Nyeri	61.6	61.9	61.8	92.1	93.1	92.6	42.5	50.3	46.3
Kirinyaga	47.8	46.8	47.3	91.3	92.4	91.3	34.0	42.1	38.0
Embu	32.6	33.1	32.8	90.4	92.1	91.3	28.3	37.0	32.6
Tharaka Nithi	33.8	34.2	34.0	87.3	89.1	88.2	23.9	30.6	27.2
Meru	33.5	34.5	34.0	84.1	85.9	85.0	19.1	25.3	22.3
Kenya	41.3	42.3	41.8	90.6	92.3	91.4	22.2	25.9	24.0

Source: Kenya Economic Survey 2014[11]

[9] Kenya Economic Survey 2014
[10] Second medium term plan 2013-2017
[11] Source of data is Ministry of Education EMIS data

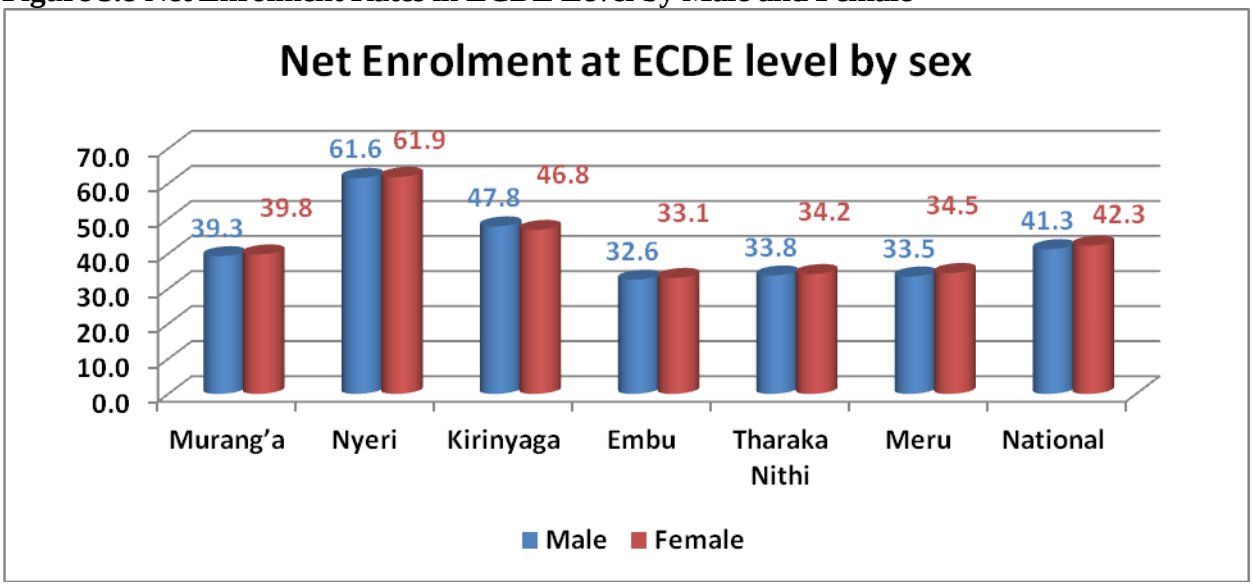
Figure 3.7: Net Enrolment Rates by County (percentage)



Source: Kenya Economic Survey 2014

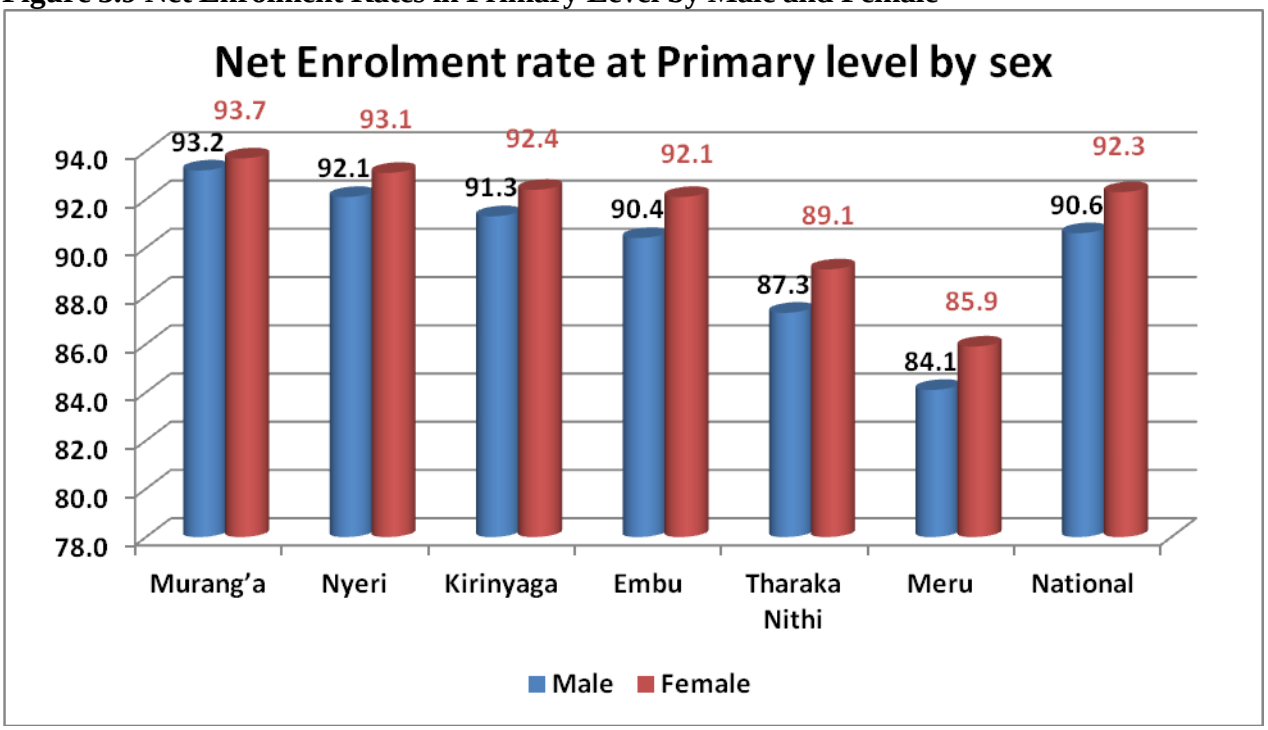
Notably, while there is near gender parity in enrolment in both ECD and primary, the margins differ significantly in secondary schools meaning that more female than males are joining secondary level of education. This may be partly linked to accessibility given that on average, there were more primary schools compared to secondary schools across all counties. Learning in secondary schools has for many years been more costly and this has worked as a deterrent for many. There is however an increase in day secondary schools that have brought down the cost of learning, and which have been complemented by increased funding from the national government for secondary education. These efforts should cumulatively result to improved enrolment.

Figure 3.8 Net Enrolment Rates in ECDE Level by Male and Female



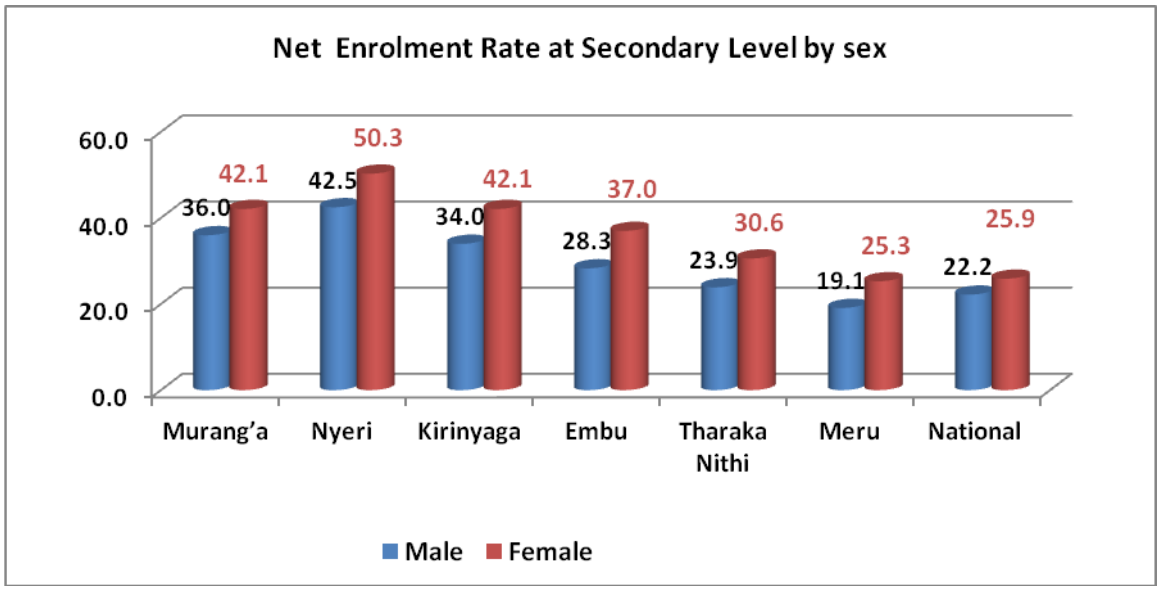
Source: Kenya economic survey 2014

Figure 3.9 Net Enrolment Rates in Primary Level by Male and Female



Source: Kenya economic survey 2014

Figure 3.10: Net Enrolment Rates in Secondary Level by Male and Female



Source: Kenya Economic survey 204

Further, data on KCPE performance in 2012 by primary schools across the counties shows that Kirinyaga topped the list of counties in the country with a mean score of about 280 marks out of a possible 500 marks. Tharaka Nithi had 260 marks, Nyeri 255 marks, Embu 250 marks, Meru 240 marks and Murang'a had 230 marks12. ECDE and Primary schools

[12]Kenya National Examination council 2013

were majority across all the counties, while the tertiary institutions were the least. Table 3.10 below shows the number of educational institutions across the counties. The figure for tertiary institution captures universities and technical institutions and does not include private colleges.

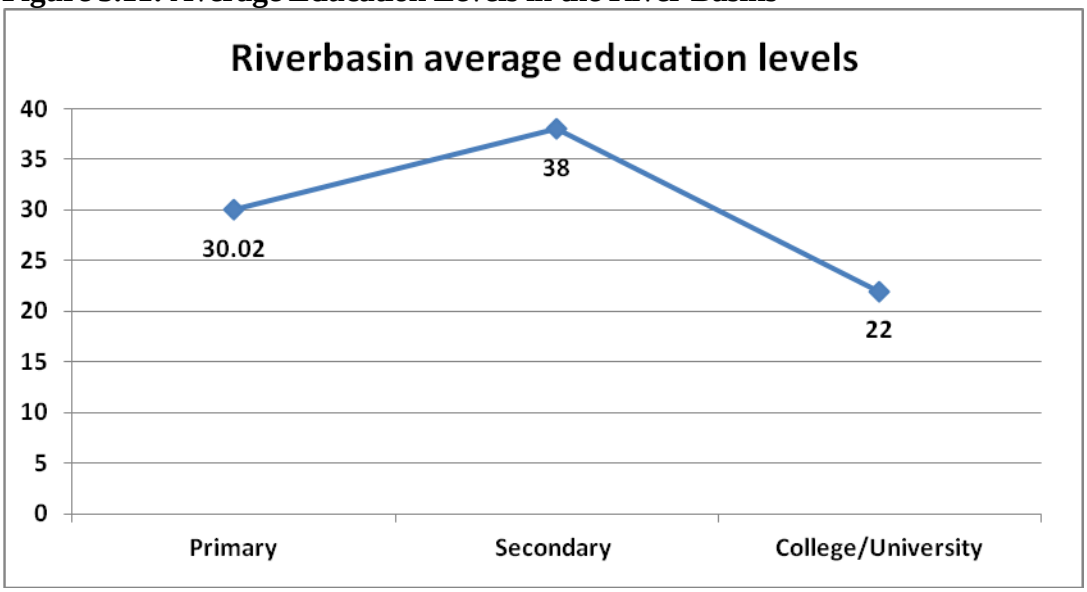
Table 3.10: Educational Institutions Across Counties

County	ECDE	Primary	Secondary	Tertiary Institutions
Murang'a	989	616	263	52
Nyeri	758	542	217	58
Kirinyaga	348	326	143	29
Embu	581	482	179	16
Tharaka Nithi	451	471	111	12
Meru	792	647	192	13

Source: Draft CIDPs, 2013-2017

Highest levels of education were explored across the river basins. The findings show that on average, 38 percent of the people in the river basins had secondary level of education, 30 percent had primary level education, while 22 percent reported to have college or university level education. This is seen in figure 3.11 below.

Figure 3.11: Average Education Levels in the River Basins



Source: field data 2014

Across the river basins, Amboni had the most people (61 percent) reporting that they had college or university education. Nairobi and Nyamindi had most people (58 percent) respectively, with secondary level education, while Mathioya had the most (55 percent) reporting they had primary level education. This is shown in the table 3.11 below. Notably, Nairobi has least people (7.5 percent) reporting that they only had primary level education; while Thingithu and Ruguti had the least number of people (6 percent respectively reporting that they had college of university education.

Table 3.11: Education Levels by River Basin

River basin	Primary (%)	Secondary (%)	College/University (%)
Nairobi	7.5	58	35
Rwamuthambi	27	30.7	38
Mariara	39	48	23
Sabasaba	44	17	17
Amboni	17	17	61
Ura	33	33	17
Nyamindi	8	58	33
Thika	19	30	41
Maragwa	27	42	21
Thangatha	36	18	21
Thiba	29	49	22
Mathioya	55	34	10
Ena tributaries	26	56	16
Maara	34	56	9
Thingithu	36	53	6
Murubara	38	48	14
Ragati	49	34	12
Rupingazi	47	27	21
Rujirweru/Bwathunaro	37	43	7
Mutonga tributaries	44	17	17
Thanantu	8	48	25
Muringato	37	31	32
Kathita tributaries	29	38	31
Kayahwe	8	34	10
Ruguti	16	26	6
Chania	23	50	27
AVERAGE	30.02	38	22

Source: Field data 2014

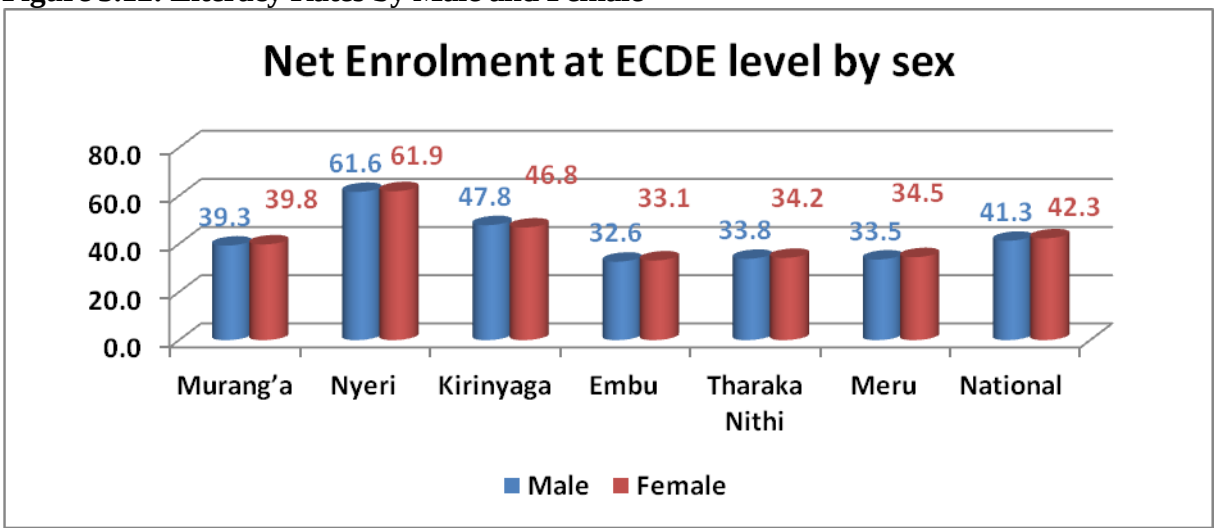
This finding indicates that an overwhelming majority of the people across the river basins had formal education, which will have a positive effect on the project especially on technology uptake because the target population has a wider choice of information sources given that most people are able to read and write.

3.1.8.1 Adult Literacy

The Government of Kenya's Medium Term Plan (2008-2012) for Vision 2030 sets the target for increasing adult literacy rate from 74 percent in 2007 to 80 percent in 2012. It is therefore interesting to see how the six counties fair in attaining this target. The results compiled from the KIHBS (2007), show that Nyeri led with literacy rates of 95 percent for male and 88

percent for female while Meru had the least rates of 78 percent for male and 74 percent for female. This is shown in figure 3.12 below.

Figure 3.12: Literacy Rates by Male and Female



Source: Kenya Economic Survey 2014

The information on literacy shows that female members of the society in all the counties continued to be disadvantaged in relation to literacy. Highest literacy rates were in Nairobi at 97 percent for male and 94 percent for female while the lowest were recorded in Turkana at 29 percent for male and 8 percent for female.

Overall, the levels of literacy and formal education attained show that the community can immensely benefit from capacity building interventions. It will be easier and faster for them to understand, seek more knowledge from other sources on information especially through the media. Farmers in the river basins will also be able to quickly understand and take up new technologies and innovations from the project

These findings were confirmed by people interviewed in groups and key informants. These observed that, across all the river basins, while access to education could be quite balanced for male and female, female generally tended to be less educated than male. This was attributed to the tendency among women to assume household chores early compared to men. The patriarchal family systems had over the past many years also significantly favoured men, particularly when a choice needed to be made on access to education13.

3.1.9 Health Indicators

This section reviews salient health indicators across the counties. The review findings show that other counties except Nyeri had fewer medical personnel than the minimum required. In

[13] Interviews with Social Development officers in various counties

Nyeri, the doctor population ratio was 1:5,00014 and 1:7,61015 while the Nurse to population ratio stood at 1: 654 and 1:834 according to the two reports quoted above respectively. This was relatively low in comparison to other counties. Discussions with key informants however revealed that the county has numerous mission and private facilities which could contribute to the better ratios. This was confirmed by the County Integrated Development Plan which indicates that in addition to the facilities shown in table 3.12 below, the county also has 3 mission hospitals, 3 private hospitals, 1 nursing home, 1 hospice, and 228 private clinics.

Table 3.12: Distribution of Medical Personnel and Facilities by County

County	Pop	Pop/ Doctor	App No of Doctors	Min Required No of Doctors	Pop/ Nurse	Min Required No of Nurses	App No of Nurses	Level 2 Dispensary	Level 3 Health centres	Level 4 District Hosp	Level 5 Provincial Hospitals
Murang'a	942,581	17,000	55	87	1,609	951	586	89	30	9	1
Kirinyaga	528,054	31,000	17	54	1,100	563	480	53	18	5	1
Nyeri	693,558	5,000	139	67	654	740	1,060	69	23	7	1
Embu	516,212	13,000	40	54	1,060	551	487	52	17	5	1
Tharaka Nithi	365,330	21,000	17	32	1,773	389	206	37	12	4	0
Meru	1,356,301	38,000	36	126	1,609	1,447	843	136	45	14	1

Source: Kenya Economic Survey 2014

3.1.10 Social and Security Dimensions

This section presents a review of literature on social and security dimensions across the six counties. It analyses the context in which the project is operating. Key literature reviewed includes the County Integrated Development Plans (CIDPs), Baseline Report on Conflict Mapping and Profiles of 47 Counties and the Constitution and Reform Education Consortium (CRECO) dated April 201216. The review was also complemented by interviews with government officials and community members across the river basins.

A review of the social and security related dimensions suggest mostly aspects across the different counties. People within respective counties share more or less the same cultural heritage. The impact of modernisation is however felt in urban areas of each county where most migrants have settled. Local cultures however prevail and by and large people strongly identify themselves along their cultural lines, which also serve as a source of unity. This implies that where the people in the highlands and the low lands share slightly different cultures, they tend to identify themselves along their sub-cultures when within the county. These sub-cultural differences however fade away when the larger county is dealing with external issues. This was particularly the case in Embu, Tharaka and Meru counties, where

[14] Kenya Economic Survey Report 2014,
[15] Draft County Integrated Development Plan
[16] www.crecokenya.org

for example, cultural differences between the people in the highlands and those in the lower lands are notable17

In general, the counties were noted to be relatively peaceful. However, there are major risks that pose significant threats to the harmony in the counties. These include youth unemployment, alcohol and substance abuse and inequalities within the respective counties. Like other parts of Kenya, youth unemployment was prevalent; many youth lay idle, and queues for job seekers were growing longer. Many youth, out of frustration were engaging in anti-social activities, including crime, alcoholism, and drug abuse. According to people interviewed, this could possibly have contributed to emergence of the outlawed groups which sometimes cause conflicts across the country.

Alcohol and substance abuse is rife among male and female in the six counties. The most recent incident was the death of over 40 people in Embu County amongst them women, following consumption of alcohol laced with methanol. Alcoholism, especially among male youth, has been an issue of concern in the counties, and several demonstrations against sale of cheap illicit liquor to youth have been witnessed in all the six counties. Miraa farming and trade particularly in Meru and Embu counties has resulted in serious social challenges. Children of school going age have dropped out of school to trade in Miraa, which offers quick money. Youth too, who are involved in miraa trade are also heavily in alcoholism, which has also resulted to family breakups.

In-equality and lack of equity in resource allocation within the counties are issues witnessing growing concern. The lowlands have for long felt that they have been disadvantaged in the distribution and sharing of development gains and resources. This perception is similar to the one where people settled in Arid and Semi-Arid Lands (ASAL) claim that resource distribution has not been equitable. People in the ASAL areas of the counties also felt that more can be done to improve their situation. These differences if not addressed have potential to cause anxiety within the counties. Interviews with community members across the river basins indicated that while differences between communities are not too pronounced, people in lower lands generally felt that their areas had not benefited from development efforts as much as the upper lands.

Access to productive resources across the population was also an issue of concern. Virtually all six counties are strongly patriarchal. Male significantly dominate ownership and control of resources including farm produce. Men own the productive assets such as land, major livestock, and machinery and what is produced. However, men are not necessarily the primary producers, as women play more direct and visible roles in local level production compared to men. Similarly, youth are a disenfranchised lot. Most do not own key assets and productive resources. They are therefore not economically active. Although they are more in number, their contribution to socio-economic issues is not felt.

[17] Interviews across the catchment, with different key informants

All the six counties have in the past experienced human- wildlife conflicts in areas next to the forests. This was for example widely reported in Nyeri, Kirinyaga, Embu, and Meru. This was nevertheless being countered through fencing off the forests. Areas without fences remain prone to animals straying to the settled lands, where they destroy food crops and threaten people's lives. People have reacted to this by physically attacking the animals, sometimes killing them.

In general, the security situation in the counties was described as stable. All counties experience relative calm. Previous incidences of activities associated with outlawed groups in parts of Murang'a, Nyeri and Kirinyaga were reported to have stopped and people were going around their businesses as usual. Kirinyaga County was reported to have witnessed isolated cases of abductions. This was reported to have been normal crime. Incidences of conflict have previously been reported around the Mwea irrigation scheme, over land and water access and usage. Individual farmers often abstract water from the irrigation canals using water pumps leading to disquiet between the community and the irrigation board. Nyeri County was reported to be relatively secure. Embu County was also quite peaceful, however, distribution and sharing of resources in the County and political intrigues were reported to be issues that could cause disquiet in the county.

Tharaka Nithi County is strongly unified by their socio-cultural heritage. Conflicts between them are limited. However, incidences of conflicts were reported in the area neighbouring Tigania. These result from use of and access to resources and differences relating to boundaries. Reports from studies done by CRECO in 2012 however suggest that the patriarchal system in Tharaka Nithi is heavily entrenched with men dominating the social scene. Further, traditions are highly respected, and these empower older men and often biased against women and youth. Meru County is relatively secure with the community coexisting harmoniously. A highly patriarch community, men in Meru dominate the socio- cultural affairs. The council of elders (Njuri Ncheke) is significantly influential in major decisions made in the County. There are no major conflicts reported in Meru, except for the area bordering Tharaka Nithi where cases of boundary related conflicts are occasionally reported. Additionally, areas that border Isiolo and Tana River have also witnessed occasional incidences of cattle rustling. These have nevertheless not significantly affected the social fabric of the county.

3.1.11 Land related Issues and Tenure Systems

Land is a major resource across the six counties as it is the main factor of production and the centre of main economic activities in the region. Land and its administration therefore attract strong interest across the county. Interviews with community members in most river basins indicated that, land is a significant factor in the identity of any individual, and usually a highly emotive issue.

Much of the land in Murang'a County is registered and an estimated 64.9 percent of farmers hold title deeds. The county has pockets of land settled by squatters, particularly around

Maragua and Kandara areas. The Nyeri County Integrated Development Plan observes that about 8 percent of people in the county are land less. These are mainly people who had settled and previously cultivated in the forests. Around Kieni, there were squatters, who reported to have been victims of double land allocations. These do not hold titles to the land they live and produce on. However, most people settled on private land have title deeds safe for about 15 percent18. Additionally, there are large chunks of land that are not accessible to people such as the forested parts of Aberdare and Mt Kenya forests, and sections occupied by Solio ranch.

Land in Kirinyaga is registered with most titles issued especially in the upper catchment. This is however not the case in Mwea especially the irrigation scheme where National Irrigation Board owns the land and people hold it on leasehold basis. This area has previously witnessed several conflicts over land ownership and access. A settlement scheme (South Ngariama Ranch) in Mwea was created in 2007 following the settlement of landless people19. An estimated 67 percent of farmers hold land titles.

An estimated 46 percent of farmers in the upper parts of Manyatta and Runyenjes have title deeds for their land compared to 10.2 percent of residents in the lower parts of Mbeere. Close to half (47 percent) of farmers in Mbeere do not have title deeds compared to just about 21 percent in the upper areas of the county. A significant 44 percent of farmers in Mbeere and 42 percent of those in Manyatta and Runyenjes are land less20. In addition, increasing population pressure in the upper parts of the county was creating pressure on older generation to cede land to the youth. This has resulted in many incidences of family conflicts as family members fight for a share of land21. Most land in the lower parts of Tharaka Nithi is adjudicated though majority of the people are yet to receive their titles deeds.22 The same applies to upper areas of the catchment. About 62.1 percent of farmers have title deeds. Meru County faces a significant challenge of population pressure with a high density of 196 persons per square kilometre. Squatters were for example reported in parts of Timau; while in the upper parts of the County, landless youth continued to exert pressure on their older parents to allocate them ancestral land23. About 50 percent of the people were reported to hold title deeds for their land. According to the CIDP 2013-2017, Meru North sub-county leads with the number of people without title deeds owing to slow process in land registration and numerous unresolved land cases.

3. 1.11.1 Land Tenure Systems

The system of land ownership is significant in all efforts aimed at improving natural resources management. Farmers with full rights to their land are more likely to invest time

[18]Nyeri County Integrated Development Plan
[19] Kirinyaga County Integrated Development Plan
[20] Draft Embu County Integrated Development Plan (Unpublished)
[21]Interviews with Community members in Embu
[22] Tharaka Nithi County Integrated Development Plan
[23] CRECO 2012, and Interviews with key informants in Meru

and resources in improving the land as opposed to those living in communally owned land. It was therefore important to establish the number of people who held privately owned land with title deeds. Overall, 43 percent of respondents reported that they were on private land with title deeds. However, interviews with farmers noted that even without title deeds most of the farmers enjoyed relatively secure land rights, given that most of the land is inherited and lack of title deeds was a result of slow registration processes and in some cases family disputes. Across the river basins, about 90 percent of respondents in Nairobi River had titles, and this led in the areas where people reported that they had title deeds. The average acreage was about 4 acres. This is shown in table 3.13 below.

Table 3.13: Percentage with Titles, Average Acreage and Range in Acres

River basin	Private with titles (%)	Average Acreage	Range in acres
Nairobi	90	4.4	0.25 - 25
Rwamuthambi	46	3.9	0.5 - 12
Mariara	52	1.9	0.25-12
Sabasaba	61	2.5	0.5-7.3
Amboni	61	18.3	1-70
Ura	58	3.5	0.25-12
Nyamindi	42	4.5	0.5-8
Thika	56	1.8	0.125-7.5
Maragwa	67	3.7	0.8-11.8
Thangatha	0	1.43	0.25-1.6
Thiba	20	5	0.75-43
Mathioya	63	2.6	0.25-10.3
Ena tributaries	18	2	0.5-4
Maara	26	5.5	0.25-40
Thingithu	21	4.3	0.25-12
Murubara	59	4.2	0.25-15
Ragati	56	2.6	0.25-31.75
Rupingazi	42	2.8	0.25-15
Rujiweru/Bwathunaro	56	3	0.25-10
Mutonga tributaries	32	3	0.25-18
Thanantu	0	6.4	0.5-50
Muringato	48	2.3	0.25 - 9.8
Kathita tributaries	36	4.1	0.25-15
Kayahwe	33	3.6	0.5-9
Ruguti	38	4.8	0.5-15
Chania	46	1.9	0.25 - 5.3
AVERAGE	43	4.00	

Source: Field data 2014

Title deeds are crucial in assuming the right to any piece of land. This survey shows that on average, 43 percent of respondents in the sampled river basins reported that they had title deeds for their land. Further consultations in group discussions and with key informants revealed that while people did not have possession of actual title deeds, most had

uninterrupted access and control over the pieces of land they laid claim on. Incidences of conflicts were however reported within families, especially in cases where the person registered as the land owner could have died and the succession incomplete. They noted that in lands where succession was complete and land properly subdivided differences were minimal. Similarly they observed that differences over boundaries beyond the family level were minimal across the river basins.

Based on discussions with farmers and key informants across the river basins, it can be concluded that the project will face minimal challenges in relation to farmer's access and control over the land they lived on, safe for those who may be squatters. These were reported to be few. However, activities that may require the strength of the title such as access to credit facilities may wish to explore alternatives forms of security. Notably the title was a treasured document and not all family members would be comfortable using the title as collateral. Such are dynamics that should be expected across the river basins.

3.1.12 Community Participation

The level of community participation in community affairs and specifically Water Resource User Associations (WRUAs) and Community Forest Associations (CFAs) was also sought. Respondents were first asked if their family members were involved in community groups, to which 67 percent answered in the affirmative. When asked which types of community groups they were involved in, almost all respondents mentioned Self Help Groups (SHGs). A follow up question was asked on whether family members were aware of the existence of WRUAs, to which about half (52 percent) answered in the affirmative, 35 percent reported that their family members were aware of the existence of CFAs.

At the river basin level, awareness of the WRUAs was high in Nairobi basin and Muringato where more than 80 percent of the respondents reported that their households were aware of presence of WRUAs in their neighbourhood. Awareness was least in Ura and Rujiweru/Bwathunaro where 17 percent reported they were aware of WRUAs respectively. WRUAs are further discussed in more detail in section 3.2**.** CFAs awareness was highest in Amboni and Rupingazi where 61 percent reported that they were aware, while awareness was least in Thiba, where only 8 percent reported that their households were aware of CFAs. These findings call for deliberate efforts to create awareness on these associations. Findings on awareness from each of the river basins are shown in table 3.14 below.

Table 3.14: Awareness Level by River Basin

River basin	Membership to groups (%)	Awareness of WRUAs (%)	Awareness of CFAs (%)
Nairobi	80	87	35
Rwamuthambi	38	38	27
Mariara	87	65	35
Sabasaba	88	68	34
Amboni	57	57	61

River basin	Membership to groups (%)	Awareness of WRUAs (%)	Awareness of CFAs (%)
Ura	83	17	16
Nyamindi	58	42	25
Thika	70	30	26
Maragwa	70	61	31
Thangatha	85	34	13
Thiba	64	24	8
Mathioya	55	66	45
Ena Tributaries	45	23	26
Maara	68	25	28
Thingithu	45	63	53
Murubara	34	68	32
Ragati	87	65	35
Rupingazi	57	57	61
Rujiweru/Bwathunaro	83	17	26
Mutonga tri	88	68	34
Thanantu	80	47	35
Muringato	92	92	47
Kathita tri	70	30	26
Kayahwe	55	46	45
Ruguti	45	63	53
Chania	68	50	42
AVERAGE	67	50	35

Source: Field data 2014

3.1.13 Awareness of People with Special Needs

The survey sought farmers' knowledge of people with special needs amongst them and the support mechanisms known to them that target this category of people. According to the findings, 63 percent of the respondents were aware of people living with disability amongst them. This percentage was higher in Sabasaba and Mutonga river basins where 88 percent of respondents in each basin reported that they were aware. Awareness was however lower in Nyamindi where 42 percent reported that they were aware. Notably, this indicator only shows awareness and it does not estimate the number of people living with disability. This notwithstanding, farmers were asked to name the types of disabilities they had noted in their areas and 32 percent mentioned mental challenges, 30 percent physical handicap, 9 percent blindness and 8 percent mentioned deaf and dumb condition. Physical handicap was more pronounced in Mariara, Amboni, Ragati and Rupingazi as mentioned by 61 percent of respondents. It was mentioned less in Ena Tributaries (4%), Thingithu (4%), Murubara (5%), and Ruguti (5%).

When respondents were asked if they were aware of support these people might be getting, on average only 21 percent were aware and the support they knew was mainly from the government and the community, which involved support with basic needs, medical support.

Findings across the river basin are shown in the table 3.15 below. Notably these findings were confirmed in discussions with other government officers as well as in Focus Group Discussions with farmers across the river basins.

Table 3.15: Awareness of People Living with Disability and Support They Received

River basin	Knowledge of people (%)	Physically Handicapped (%)	Blind (%)	Deaf and Dumb (%)	Mentally challenged (%)	Knowledge of assistance (%)
Nairobi	63	50	6	6	12	12
Rwamuthambi	54	23	8	15	23	23
Mariara	74	61	4	17	26	30
Sabasaba	88	46	41	5	17	18
Amboni	78	61	0	4	61	22
Ura	75	50	4	0	46	8
Nyamindi	42	16	8	16	25	8
Thika	52	37	7	7	15	0
Maragwa	45	22	23	4	45	5
Thangatha	54	41	3	10	35	5
Thiba	50	18	5	3	36	6
Mathioya	66	16	8	6	49	6
Ena Tributaries	53	4	6	8	52	23
Maara	69	24	4	7	41	48
Thingithu	48	5	7	5	37	45
Murubara	63	5	6	8	17	45
Ragati	74	61	4	17	26	30
Rupingazi	78	61	0	4	61	22
Rujiweru/Bwathunaro	75	35	4	0	30	8
Mutonga tri	88	24	41	9	6	38
Thanantu	63	34	8	6	14	42
Muringato	54	10	6	15	33	23
Kathita tri	52	37	7	7	15	0
Kayahwe	66	16	8	6	49	6
Ruguti	48	5	7	5	37	45
Chania	73	30	8	12	36	34
AVERAGE	63	30	9	8	32	21

Source: Field data 2014

3.1.14 Actors (NGOs, CSOs, SHGs) in the Project Area

The survey further sought to establish the other development actors in the project area and nature of community organisations besides WRUAs and CFAs that exist. According to the draft County Integrated Development Plans, cooperative societies, SACCOs, women groups and youth groups were the most common forms of organisations across the six counties. Cooperatives were more in agriculture; SACCOs were more common in trade and housing activities while women groups and youth groups were more geared to supporting member's

social welfare, though most were also involved in many Income Generating Activities in the agricultural, trading among other sectors. Most women and youth groups were registered as Self Help Groups (SHGs). Non-Governmental Organisations were also present in all counties

Nyeri County had 116 active cooperative societies and 28 dormant ones. These were in the dairy, Coffee and transport sectors. Total membership to the cooperative societies was estimated at 287,069 people. At least six (6) NGOs were active in the county including Caritas, World Vision, Green Belt Movement, Kenya Red Cross, Anglican Development and Farm Concern. Self Help Groups were estimated at 14,391. About 4,489 were women groups, 1,338 youth groups and 8,564 were mixed gender and age SHGs.

In Murang'a County, cooperative societies were estimated at 155 of which 120 were active and 35 were dormant. Cooperatives had a total membership of 332,420 people. NGOs in the county were about 10, which include Vihda Association, GIZ, Africa Now and YARD. Self Help Groups were estimated at 1,832 of which 676 were by youth and 1,156 by women.

Kirinyaga County had 86 cooperatives. Of these 18 were for coffee farmers and had a membership of 105446 farmers. There were twenty five (25) SACCOs, with a total, membership of 103,982, eleven (11) housing cooperatives with a membership of 21,192, six (6) irrigation cooperatives with a membership of 4,723, three (3) dairy cooperatives with a total membership of 1,461 farmers, two multipurpose cooperatives with a total membership of 5,323, two (2) estate cooperatives with a membership of 1,042 and two (2) cooperative unions with a membership of 21. In total the cooperative movement in the county had a total membership of 243,240 and total turnover exceeding Kshs. 2 billion. An estimated 603 NGOs were present in the county while SHGs were estimated at 4,763 of which 1,345 were by women and 1,164 by youth.

Meru County had 58 cooperatives with a total membership of 56,091. These were mainly in agriculture and retail businesses. About 47 cooperatives were active and 11 were reported as dormant. There were about 26 NGOs which include Ripples International, and AMREF. Further the county had 1,841 women groups and 1,200 youth groups.

Embu County had 49 cooperative societies. These take the form of SACCOs (28), Multi-purpose societies (13), Dairy (1) Housing societies (6) and one (1) cooperative union. An estimated 16 NGOs were operational in the county including Red Cross, Care International, Action Aid, Caritas and Aphia plus among others. The county also had many SHGs.

Tharaka Nithi had several cooperative societies though the actual number was not available. SHGs were reported to be in excess of 500 that were registered. Over 200 CBOs were also registered and more than ten (10) faith based organisations were active in the county. Five (5) NGOs were operational in the county including Child Fund, Plan International, Compassion, and Save the Children among others.

Overall, with about 67 percent of the respondents reporting that they were in groups and as evidenced by the many cooperative societies in the target river basins and counties, it means that farmers din this area are cooperators who are able to team up together for their mutual benefit. As such they will be able to take advantage of the matching grants from the project. There was also potential for registration of new groups to partner with the project.

3.1.15 Other Cross Cutting Issues

The six counties are also faced with other social challenges that may be of concern to this project. Interviews with farmers reported that though not many, there were several child headed households in the river basins which needed attention. These could be children whose parents have died or separated and consequently deserted by the parents. The effects of illnesses such as HIV and AIDS have been strongly felt in the counties. Numerous resources have been used by families to manage ill health by family members. HIV/AIDS, Cancer and other terminal illnesses have orphaned many children, and left widows and widowers. The management of these illnesses was reported to be increasingly becoming a major burden to households, some of which are forced to dispose of assets to pay medical bills. Key informants noted that preventive measures would best address such challenges. In addition the counties also had several widows that have been disinherited following the death of their spouses. Such people lived in vulnerability, either as tenants and squatters.

The increasing youthful population continued to exert pressure on the environment and they were aggressive in taking up opportunities they came across irrespective of their impact on the environment. Key informants for example reported the increasing number of youth involved in the motorcycle business, where they operate without much caution leading to accidents and consequent death and hospitalisation. Youth were also reported to occupy riparian land where they carry out car wash businesses and therefore affecting the quality and quantity of water flowing downstream.

3.1.16Key Recommendations

i. SCMPs may need to more prominently highlight socio-economic issues at the community level. A review of most SCMPs shows that most paid more attention to water resource and environmental challenges. Social aspects and challenges that may affect implementation of the plan such as leadership challenges, community organization etc. needs to be analysed and understood from the onset.
ii. The project will need to devise a mechanism of flagging out people within the river basins that could be facing unique challenges such as single mothers without access to land, people with disability, the elderly and others with special needs. Approaches for social inclusion of this category of people will need to be thought through and income generating activities targeting them designed.
iii. The project will need to make use of the high levels of education reported in the river basins by ensuring supply of relevant information through available forms of media such as print and/ or cell phone.

iv. The river basins were not homogenous; each had its own unique aspects. As such project interventions will need to be river basin specific if they will make sense to farmers across the river basins.

v. It will add value for the project to partner closely with other actors such as department for social development, in deliberately designing interventions for the people with special needs. Social inclusion of all farmers is essential in poverty reduction efforts.

vi. The number of people reporting that casual labour was a source of income for them was high. Additionally, hired permanent and temporary labour was common across the river basins. It is important to note that those involved in farm labour may not always be the owners of the land, but they could be hired labour. This has implications on many issues such as decisions made in relation to production and target groups for capacity building.

3.2WATER RESOURCES MANAGEMENT

3.2.1Background

The river basins under the Upper Tana Natural Resources Management (UTANRMP) are within the Mt.Kenya and Aberdares drainage which discharges into the Tana River system. The climate of Mt.Kenya and Aberdares regions is largely determined by altitude. There are great differences in altitude within short distances, which determine a great variation in climate over relatively small distances. The altitudes with the highest rainfall are between 2,700 and 3,100m, while above 4,500m most precipitation falls as snow or hail. Frosts are common at above 2500m asl, while in the lower zones of the ecosystem the mean climate conditions are hot and semi-arid especially in the lower areas of Embu and Tharaka Nithi counties.

Rainfall pattern in Mt.Kenya and Aberdares ecosystems is bimodal, Ranging from 900 mm to 2,300 mm with maximum rains falling during months of March to June and November to December. The driest months are January, February, August and September with the windward side experiencing the strongest effects of the trade winds system.

The management of Water resources is vested with the Water Resources Management Authority (WRMA), which is a state corporation in partnership with the community based Water Resource Users Associations (WRUA's).

3.2.2Water Resources Users Associations (WRUAs)

Stakeholders need to be involved in management of public natural resources. The involvement of the stakeholders in water resources management is through engagement of Water Resources Users Associations.

3.2.2.1Water Resources Users Associations Establishment

The Water Resources Users Association is established by the Water Act 2002. In the Water Act 2002, the Water Resources Management Authority (WRMA) is expected to formulate Catchment Management Strategy for the management, use, development, conservation, protection and control of water resources within each catchment area (Water Act 2002 section 5, subsection 1). The catchment management strategy is to provide mechanism and facilities for enabling the public and communities to participate in managing the water resources within each catchment area (Water Act 2002 section 5, subsection 3[e]). Therefore the catchment management strategy encourages and facilitates the establishment and operation of Water Resources Users Associations for conflict resolutions and co-operative management of water resources in catchment areas (Water Act 2002 section 5, subsection 5). The WRUA formation and operation is as per section 10, sub sections 1 to 14 of the Water Resources Management Rules 2007.

Initially, Water Resources Management Authority (WRMA) targeted sub catchments which had conflicts or issues by water resources users relating to the quality or quantity of the water. Such a situation made it easy to put together the stakeholders because all felt the need to solve or manage the problem or the conflict. This gave the stakeholders time to know and understand the catchment, its features and the available resources. They would also understand better the issues related to water quality and quantity issues like water pollution, water shortage and areas which are hotspots within the catchment.

3.2.2.2Water Resource Users Associations Membership

The membership of WRUAs constitutes both internal and external stakeholders. The internal stakeholders include water abstractors, riparian land owners, and farmers. Also institutions like schools, markets, factories plus groups within the catchment are stakeholders. The external stakeholders include institutions and their agents who have stake on the activities in the catchment. Such institutions include Water Resources Management Authority (WRMA), National Environment Management Authority (NEMA), Kenya Forest Service (KFS), Kenya Wildlife Service (KWS), County and National Government administrators plus other relevant Non-Governmental Organization (NGO) like Green Belt. Membership numbers vary with time and may increase when new players come into the catchment while reduction of membership may be due to relocation of some of the players to other catchments.

3.2.2.3 Water Resource Users Association Management and Development

To ensure effective operations of the Water Resources Users Associations, Water Resources Management Authority (WRMA) found the ways and means of facilitating the Water Resource Users Associations through Water Services Trust Fund (WSTF). Therefore WRMA and WSTF developed the Water Resources Users Association Development Cycle (WDC). The WDC gives the justification, objective, approach and background on water resources users associations. The Water Resources Users Association Development Cycle also provides the ways of developing the Sub-Catchment Management Plans, sourcing of funds and implementation of the activities plus monitoring and evaluation.

The Water Resource Users Associations are expected to be registered with WRMA and other relevant bodies including Registrar of Societies to ensure legal status. Management of Water Resources Users Associations is through the main management committee which gives the overall leadership and three sub-committees which are:

i. Finance committee which develops budgets, checks expenditure and mobilizes resources.
ii. Procurement committee which undertakes procurement of materials and services.
iii. Monitoring committee which checks whether the constitution is followed, the procedures are followed and action plans are implemented.

However WRUAs have different number of total committee members and the WRUAs interviewed during the field visits indicated a varying number ranging from 15 to 23. According to WRMA, it was realized that some WRUAs were commanding too big a catchment while others were commanding too small a catchment. Therefore WRMA decided

to rationalize the WRUAs so that most in Upper Tana catchment cover areas between 50km^2 to 250km^2.There are some in the very ASAL areas which cover over 250km^2. Before the rationalization, there were some WRUAs covering sub catchments which were less than 30km^2.However, after Rationalization, Rupingazi, which earlier had several small WRUAs like Kiiye, Thambana, Nyanjara and Kapingazi will have two WRUAs which are Upper Rupingazi which covers the catchment upstream of bridge at Embu and the Lower Rupingazi which covers catchment downstream of the bridge and includes Kapingazi Catchment.

In the rationalized list, there are designated WRUAs covering the entire Tana Catchment with WRUAs already formed and other WRUAs proposed to be formed. This calls for a process of putting together the existing Sub Catchment Management Plans (SCMP) to form one for the rationalized WRUAs, while those sub catchments without WRUAs are targeted for facilitating the formation of WRUAs.

3.2.2.4 WRUAs Eligible Activities as per WRUA Development Cycle

According to the Water Act 2002, WRUAs are expected to be facilitated by Water Services Trust Fund (WSTF) to develop Sub Catchment Management Plans (SCMP) which will guide in the management of the Water Resources. The Sub Catchment Management Plans have to be reviewed after every five years.

The Sub Catchment Management Plans usually propose many activities to be implemented but the specific activities for funding through Water Resources Users Association Development Cycle process are:

i. Baseline data collection on available resources and on the environment.
ii. Monitoring and assessing water resources availability, quality and use.
iii. Preparation and implementation of water allocation plans to improve water resources management and use and reduce conflicts.
iv. Infrastructure planning and development to improve water availability, efficient use and compliance to regulations (e.g. common intake, master meters, water harvesting and improve on irrigation technologies).
v. Conservation and rehabilitation of catchments and riparian areas.
vi. Control and reduction of effluent discharges.
vii. WRUA mobilization, training and capacity building.
viii. Strengthening of WRUA management systems.

In the process of formation, WRUAs are initially registered with Social Services and later with the Attorney General under the Societies Act to have a legal status. This enables the WRUAs to out-source funds for their activities and account for the money. Therefore, WRUAs are at various levels of formation and development with some in the process of developing the Sub Catchment Management Plans while others are implementing the proposed activities.The following is an inventory of existing WRUAs in the MKEPP River Basins tributaries and the 24 river basins:

Table 3.16: Water Resources Users Associations in MKEPP River Basin (Tributaries)

River Basin	WRUA Name	River covered	Membership	Management structure	Activities performed
Kapingazi/ Rupingazi	Upper Rupingazi (within are Kiiye, Nyanjara and Thambana WRUAs)	Rupingazi (upstream of Embu bridge)	Membership is composed of stake holders and numbers vary	Management committee with sub committees - 1) Executive , 2) Finance, 3) Procurement, 4) Monitoring and evaluation.	- Developed a Kiiye and Thambana SCMP - River line pegging -Abstraction Survey -Tree Planting - Thambana WRUA fixed meters and control devices
	Lower Rupingazi (within is Kapingazi WRUA)	Rupingazi (downstream of Embu bridge)			- Developed the Kapingazi SCMP - River line pegging - Abstraction survey -Tree Planting - Registered with Attorney General
	Itabua	Itabua (joins Thiba river downstream of the confluence of Rupingazi and Thiba)			- WRUA formed
Ena	Upper Ena	Ena (upstream of Ena bridge)	Membership is composed of stake holders and numbers vary	Management committee with sub committees - 1) Executive , 2) Finance, 3) Procurement, 4) Monitoring and evaluation.	- Developed a SCMP
	Middle Ena	Ena (d/s of Ena bridge and u/s of BAT bridge)			- Developed a SCMP
	Lower Ena	Ena (d/s of Bat bridge), Itimbogo,			-Proposed WRUA
	Gangara	Gangara			Proposed WRUA
	Thura	Thura (joins Tana river upstream of the confluence of Ena and Tana)			Proposed WRUA
	Wanjoga	Wanjoga			-Proposed WRUA
	Kiriiri	Streams in Kiriiri area			-WRUA formed
	Mavuria	Mavuria			-Proposed WRUA
	Gichiche	Streams in Gichiche area			-WRUA formed
	Riachina	Streams in Riachina area			-WRUA Formed
	Kiambere	Streams in Kiambere hill			-Proposed WRUA
Kithinu/ Mutonga	Upper Thuci	Thuci			-Proposed WRUA
	Lower Thuci	Thuci			-Proposed WRUA

River Basin	WRUA Name	River covered	Membership	Management structure	Activities performed
	Naka	Naka			-Proposed WRUA
	Nithi	Nithi	Membership is composed of stake holders and numbers vary	Management committee with sub committees - 1) Executive , 2) Finance, 3) Procurement, 4) Monitoring and evaluation.	-WRUA formed -Registered with Attorney General
	Maara South	Maara south			-Proposed WRUA
	Maara North	Maara North			-Proposed WRUA
	Upper Mutonga	Mutonga			-Developed a SCMP -Registered with Attorney General
	Middle Mutonga	Mutonga			-Registered with Attorney General -Developed a SCMP
	Lower Mutonga	Mutonga			-Registered with Attorney General
	Kiriria Mutonga	Kiriria			-Registered with Attorney General -Developed a SCMP
	Kithinu	Kithinu			-Developed a SCMP -Registered with Attorney General
Kathita	Upper Kathita (within is Ruji, wa Ngombe WRUAs)	Kathita,			-Registered with Attorney General
	Gachiege/ kanyuango	Kanyuango/Riiji (Liji) joins Mariara	Membership is composed of stake holders and numbers vary	Management committee with sub committees - 1) Executive , 2) Finance, 3) Procurement, 4) Monitoring and evaluation	- Developed a SCMP -Registered with Attorney General
	Ngakinya	Ngaciuma and Kinyaritha			-Developed a SCMP -River line pegging -Abstraction survey -Registered with Attorney General
	Kuuru	Kuuru			-Proposed WRUA
	Middle Kathita	Kathita			-Developed a SCMP -Registered with Attorney General
	Lower Kathita	Kathita			- Registered with Attorney General

Source: WRMA records - March 2014

Table 3.17: Water Resources Users Associations in UTaNRMP Priority River Basins

River Basin	WRUA Name	River covered	Membership	Management structure	Activities performed
Thika/ Sasumua	Sasumua	Sasumua	Membership is composed of stake holders and numbers vary. (Currently 19)	Management committee with sub committees - 1) Executive , 2) Finance, 3) Procurement, 4) Monitoring and evaluation.	-Developed a SCMP -River line pegging -Abstraction survey - Tree planting -Registered with Attorney General
	Upper Thika	Thika (upstream of Ndakaini Dam)	Membership is composed of stake holders and numbers vary	Management committee with sub committees - 1) Executive , 2) Finance, 3) Procurement, 4) Monitoring and evaluation.	-Developed a SCMP -Registered with Attorney General
	Middle Thika	Thika (downstream of Ndakaini dam and upstream of Yatta furrow)			-Developed a SCMP - Tree planting -Spring protection -Registered with Attorney General
	Lower Thika	Thika (downstream of Yatta furrow)			-WRUA just formed
Saba Saba	Saba Saba	Saba Saba			-Developed a SCMP - Developed two check dams -Tree planting - Registered with Attorney General
	Lower Saba Saba	Lower Saba Saba			Proposed WRUA
Maragua	Upper Maragua	Maragua (upper part)			- WRUA formed
	Lower Maragua/ Githanjo	Maragua (lower part)			-Developed a SCMP -Registered with Attorney General
Nairobi	Nairobi	Nairobi			-Developed a SCMP -Registered with Attorney General
Ragati	Ragati	Ragati			-Developed a SCMP -River line pegging -Abstraction survey (lower part) - Tree planting -Registered with Attorney General
Thiba	Upper Thiba (within are Kamweti, New Kandakame, Mukengeria, and Kamuthiga WRUAs)	Thiba (upstream of Kutus bridge)			-Developed a SCMP -River line pegging -Abstraction survey - Tree planting - Registered with Attorney General

River Basin	WRUA Name	River covered	Membership	Management structure	Activities performed
	Middle Thiba	Thiba (d/s of Kutus bridge and u/s confluence with Rupingazi			-Developed a SCMP
	Lower Thiba	Thiba(d/s of confluence with Rupingazi)	Membership is composed of stake holders and numbers vary	Management committee with sub committees - 1) Executive , 2) Finance, 3) Procurement, 4) Monitoring and evaluation.	-Proposed WRUA
Murubara	Murubara	Murubara			-Developed a SCMP -Abstraction survey -Registered with Attorney General
Rupingazi	Upper Rupingazi (within are Kiiye, Nyanjara and Thambana WRUAs)	Rupingazi (upstream of Embu bridge)			-Developed a Kiiye and Thambana SCMP -River line pegging -Abstraction survey -tree planting -Thambana WRUA fixed meters and control devices - Registered with Attorney General
	Lower Rupingazi (within is Kapingazi WRUA)	Rupingazi (downstream of Embu bridge)			-Developed a Kapingazi SCMP -River line pegging -Abstraction survey -tree planting - Registered with Attorney General
Thingithu	Upper Thingithu	Thingithu			WRUA formed
	Lower Thingithu	Thingithu			-Proposed WRUA
Thanantu	Upper Thanantu	Thanantu			-Registered with Attorney General
	Lower Thanantu	Thanantu			-Proposed WRUA
Thangatha	Upper Thangatha	Thangatha			- Developed a SCMP -Registered with Attorney General
	Lower Thangatha	Thangatha			-Proposed WRUA
Rujiweru	Rujiweru	Rujiweru			-Developed a SCMP - Baseline survey -Abstraction survey -Protected three wetlands and one spring - Initial training -Registered with Attorney General
	Marera	Marera			Proposed WRUA

Source: WRMA records - March 2014

Table 3.18: Water Resources Users Associations in UTaNRMP Other River Basins

River Basin	WRUA Name	River covered	Membership	Management structure	Activities performed
Lower Chania	Lower Chania	Chania (downstream of Sasumua Dam)	Membership is composed of stake holders and numbers vary	Management committee with sub committees: 1) Executive , 2) Finance, 3) Procurement 4) Monitoring and evaluation.	- WRUA formed
Kayahwe	Kayahwe	Kayahwe (upstream of the confluence with Maragua)			- Developed a SCMP - River line pegging - Abstraction survey -Tree planting -Registered with Attorney General
Mathioya	Upper Mathioya	Mathioya			- Developed a SCMP -Registered with Attorney General
	Lower Mathioya	Mathioya			- Developed a SCMP -Registered with Attorney General
Amboni/ Muringato	Amboni	Amboni			- Developed a SCMP -Registered with Attorney General
	Muringato	Muringato			-WRUA formed
Sagana	Upper Sagana	Sagana (upstream of confluence with Chania)			- Developed a SCMP - River line pegging - Abstraction survey -Tree planting -Registered with Attorney General
	Lower Sagana	Sagana			- Proposed WRUA
Rwamuthambi	Rwamuthambi (within are Rwarucaka (upper part) and Lower Rwamuthambi)	Rwamuthambi			Rwarucaka WRUA has - Developed a SCMP - River line pegging - Abstraction survey (lower part) - Tree planting -Registered with Attorney General -Lower Rwamuthambi WRUA formed
Nyamindi	Upper Nyamindi	Nyamindi			- River line pegging - Tree planting
	Lower Nyamindi	Nyamindi			- Developed a SCMP
Ruguti	Ruguti	Ruguti			- Proposed WRUA
Mara	Maara North	Maara North/ Mara			- Proposed WRUA
Iraru	Iraru	Iraru			- Proposed WRUA
Mariara	Mariara	Mariara			- Developed a SCMP -Registered with Attorney General
Ura	Upper Ura	Ura			WRUA formed
	Lower Ura	Ura			- Proposed WRUA

Source: WRMA records - March 2014

The WRUAs are either at proposed stage, just formed or formed with SCMP. Some of them have started implementing the activities proposed in the SCMPs at different levels.

The following is a summary of WRUAs at various stages in the UTaNRMP river basins as shown in Table 3.19

Table 3.19: Summary of the WRUAs in the UTaNRMP River Basins

Category of WRUA	No. of WRUAs	% of total WRUAs
Proposed WRUAs	22	31
Formed WRUAs and no SCMP	15	21
WRUAs with SCMPs and no implementation activity	18	25
WRUAs with SCMPs and implementing activities	16	23
Total	71	100

About 52% of the WRUAs are either not formed or are yet to developed the SCMPs while about 25% have not started implementing their activities. Therefore it is important to form the WRUAs not formed, assist in development of the SCMPs and implementation of the activities.

3.2.3 Water Users Association (WUA)

There is need for supply of domestic water to be harmonized for effective supply of water to the consumers. This is done through engagement of Water Users Associations who are usually the water service providers.

3.2.3.1 Water Users Association Establishment

The Water Users Association/ Service Provider is established by the Water Act 2002 section 55, sub section (1) as an entity to provide water and sewerage services to the consumers. The Water Services Board (WSB) is given the license by the Water Services Regulatory Board (WSRB) to provided water services in a given area like the Tana Water Services Board covers the six counties under UTaNRMP. The WSB contract companies as service providers or organizations to provide the service through a service provision agreement as indicated in section 55 sub sections (2, 3, 4 and 5) of the Water act (2002). It important to note that all water supplies for domestic water to more than 20 households or supplying more than $25m^3$ per for domestic purposes or $100m^3$ per day for any other purpose requires a license as per section 56, sub section (1) of the Water Act 2002. Therefore there are many water users associations who operate though not contracted by the WSB.

The Water Act of 2002 gives the mandate of water services to the Water Services Boards which assign agents to do it within their area of supply. The six Counties covered by UTaNRMP (Meru, Tharaka Nithi, Embu, Kirinyaga, Nyeri and Muranga are under Tana

Water Services Board (TWSB). The Water Service Board (WSB) targeted the urban and rural water supplies with those supplying towns given the first priority. Therefore Companies (which are the Water Users Association (WUA) were given licenses to provide water and sewerage services starting with towns where most of the water projects were operated by the Local Government and the National Government through the Ministry of Water and Irrigation. The following is the list of WUAs with water service provision agreement with Tana Water Services Board according to TWSB as in table 3.20

Table 3.20: List of the WUAs with Service Provision Agreement from TWSB

Water Service Provider (WUA)	Service area/ Towns	Population served	Capacity (m3/day)
Nyeri W S C	Nyeri	89,582	27,000
Embu W S C	Embu	83,865	12,000
Kirinyaga W S C	Kerugoya, Kutus, Wanguru, Sagana	186,365	19,452
Mathira W S C	Karatina, Mathira	29,760	17,000
Meru W S C	Meru	56,914	4,509
Muranga W S C	Muranga	32,034	4,848
Othaya/ Mukuruweini	Othaya, Mukurweini	85,782	16,616
Kahuti	Kangema	52,578	9,000
Muranga South	Kigumo, Kandara, Maragwa, Saba Saba	119,346	9,220
Gichugu	Gichugu	29,928	17,717
Gatanga Community	Gatanga	36,354	5,418
Nithi	Chogoria, Chuka	35,799	3,300
Ngandori - Nginda	Manyatta, Mutunduri	49,977	15,000
Gatha Mati	Njumbi, Kiriani	38,930	8,391
Kyeni	Kathangari, Karurumo	8,916	527
Imetha	Nkubu, Timau, Kanyekini, Tigania, Maua, Mitunguu, Mwimbi, Ruiri	52,698	4,100
Muthambi 4K	Muthambi	11,259	-
Kathita/ Kiirwa (CEFA)	Kiirwa	16,788	1,253
Ngagaka	Kianjokoma	27,502	24,780
Tetu Aberdare	Tetu, Kinaini, Titie	72,403	7,037
Rukanga	Rukanga	-	800
Murugi Mukumago	Mukumago	15,612	-
Ruiri Thau Water Association	Ruiri	13,892	1,080
Embu	Ishiara, Ena, Siakago	7,871	6,733

Source: Tana Water Service Board Records as of 2013.

Currently, there are 23 WUAs with service provision agreement from TWSB though there are others water projects by communities/ individuals or public which are yet to get the service

provision agreement to supply water to consumers as provided for by the law (Water Act 2002).

3.2.3.2 Water Users Association Membership

Normally, the membership of registered WUAs by WSB is composed of the County Government Representatives, the local Community (either through the existing institutions like the church, Chamber of Commerce and major water consumers) and any other relevant stakeholder. However the unregistered WUAs have their membership from the participating owners of the infrastructure. The membership of the WUAs is therefore composed of the stakeholders who are the owners of the infrastructure and the users of the water services.

The membership and management structure is guided by instructions and guidance of the Water Services Regulatory Board. Currently, the Water and Sewerage Companies are expected to have nine (9) Directors though there are cases of more directors. Meru water and sewerage has 9 directors while Embu water and sewerage and IMETHA water and sewerage have 11 directors and 13 directors respectively.
However, there are WUAs not registered by WSB but provide water services and the membership is composed of stakeholders who are the consumers and owners. They normally elect committees who govern, operate and manage the water project based on the group constitution.

3.2.3.3 Water Users Associations Management and Development

Several water and sewerage companies/Water Users Associations (registered with TWSB) were established targeting major towns and high water demand areas while one water and sewerage company like Imetha was formed to operate several government water projects within Meru and Tharaka Nithi Counties. Therefore other areas are still covered by Community or private Water Projects/Water Users Associations which have not been registered with TWSB.

After the 2010 constitution, the Water services were devolved to the County Government, hence most companies are being controlled at county level. The first Water Users Associations were established in towns like Nyeri, Karatina, Meru, Embu, Muranga etc. while using the existing public facilities, and delinked the operations from the mainstream local and Central government. The registered Water Users Associations operate as per the agreement with the service boards based on the regulations of the Water Services Regulatory Board. However, the WUAs not registered operate within the general water guideline and their constitution.

The WSB objective is to have registered Water Users Associations cover effectively the entire area covered by Water Services Board which follow the Administrative/ County Boundaries. The Government or Donors can invest in the development of the infrastructure of

the companies/ Water Users Associations which runs the water and Sewerage System on behalf of the community.

Currently 3,375 community and private water projects in UTaNRMP river basins have domestic and irrigation water component which vary in sizes. After the bigger community or private water projects are registered as Service Providers/ WUAs, the other smaller projects can be put under one management as a service provider/ WUA. Maybe every county may have one or several Water Users Associations (water and sewerage companies) to cover the entire county.

The service providers (WUAs) are for domestic water supply though some Water projects target both irrigation and domestic hence the water is not treated or safe for drinking. There should be a regulator or coordinator for Irrigation Water Users Associations

The following is an inventory of registered Water Users Associations in the Upper Tana Natural Resources Management Project River Basins as shown in Table 3.21 and 3.22.

There are big water projects which are owned by the community or are public. The water supply systems which are abstraction over 1,000.0m3 per day for domestic water are big domestic water supply projects and need to be registered as WUAs by the WSB. There are about 116 water supply systems in UTaNRMP river basins which abstract over 1,000m3 per day for domestic water and only 40 water supply systems are registered with WSB. This means that 76 water supply systems can be targeted for registration with WSB possibly when they meet the required conditions.

The advantage of registration and having a contract with the WSB is that the WUAs are regulated and constant monitoring and evaluation is maintained by the WSB on the quality of water they provide.

Table 3.21: Water Users Associations in MKEPP River Basins (Tributaries)

River Basin	WUA Name	Area Served	Membership	Management structure	Activities performed
Kapingazi/ Rupingazi	Embu WSC	Embu	Stakeholders (dominated by county government)	Board of directors (usually 9)	Provision of water and sewerage services
	Ngagaka	Kianjokoma	Stakeholders (dominated by community)		Provision of water and sewerage services
	Ngandori Nginda	Manyatta, Mutunduri			Provision of water and sewerage services
Ena	Embu	Ishiara, Ena, Siakago	Stakeholders (dominated by county government)		Provision of water and sewerage services
	Kyeni	Kathangeri, Karurumo	Stakeholders (dominated by community)		Provision of water and sewerage services
Kithinu/ Mutonga	Imetha	Nkubu, Timau, Kanyekini, Tigania, Maua, Mitunguu, Mwimbi, Ruiri	Stakeholders (dominated by county government)		Provision of water and sewerage services
	Muthambi 4K	Muthambi	Stakeholders (dominated by community)		Provision of water and sewerage services
	Nithi	Chogoria, Chuka	Stakeholders (dominated by county government)		Provision of water and sewerage services
	Murungi Mukumangu	Mukumangu	Stakeholders (dominated by community)		Provision of water and sewerage services
	Imetha (operate several water projects)	Nkubu, Timau, Kanyekini, Tigania, Maua, Mitunguu, Mwimbi,	Stakeholders (dominated by county government)		Provision of water and sewerage services
Tungu	Nithi	Chogoria, Chuka			Provision of water and sewerage services
Kathita	Meru WSC	Meru		Board of Trustee (usually 9)	Provision of water and sewerage services
	Ruiri Thau Water Association	Ruiri	Stakeholders (dominated by community)		

Source: Tana Water Services Board and water companies/Water Users Associations

Table 3.22: Water Users Associations in UTaNRMP Priority River Basins

River Basin	WUA Name	Area Served	Membership	Management structure	Activities performed
Thika/ Sasumua	Thika WSC	Thika	Stakeholders (dominated by county government)	Board of directors (usually 9)	Provision of water and sewerage services
	Gatanga community WP	Gatanga	Stakeholders (dominated by county government	Board of directors (usually 9)	Provision of water and sewerage services
	Upper Chania	Njambini	Stakeholders (dominated by county government	Board of directors (usually 9)	Provision of water and sewerage services
Saba Saba	Muranga South	Saba Saba	Stakeholders (dominated by county government)	Board of directors (usually 9)	Provision of water and sewerage services
Maragua	Muranga South	Kigumo, Kandara, Maragwa	Stakeholders (dominated by county government)	Board of directors (usually 9)	Provision of water and sewerage services
Nairobi	Nyeri WSC	Nyeri	Stakeholders (dominated by county government)	Board of directors (usually 9)	Provision of water and sewerage services
Ragati	Mathira WSC	Mathira	Stakeholders (dominated by county government)	Board of directors (usually 9)	Provision of water and sewerage services
Thiba	Kirinyaga WSC	Kerugoya, Kutus, Wanguru,	Stakeholders (dominated by community)	Board of directors (usually 9)	Provision of water and sewerage services
Murubara	Kirinyaga WSC	Kimbimbi	Stakeholders (dominated by county government)	Board of directors (usually 9)	Provision of water and sewerage services
Rupingazi	Embu WSC	Embu	Stakeholders (dominated by county government)	Board of Trustee (usually 9)	Provision of water and sewerage services
Thingithu	Imetha WSC	Nkubu	Stakeholders (dominated by community)	Board of Trustee (usually 9)	Provision of water and sewerage services
Thanantu	Imetha WSC	Tigania,	Stakeholders (dominated by community)	Board of Trustee (usually 9)	Provision of water and sewerage services

Source: Tana Water Services Board and water companies/ Water Users Associations

Table 3.23: Water Users Associations in UTANRMP other River Basins

River Basin	WUA Name	Area Served	Membership	Management structure	Activities performed
Lower Chania	Gatanga community WP	Gatanga	Stakeholders (dominated by Community)	Management committee	Provision of water services
	Upper Chania	Njambini	Stakeholders (dominated by community)	Management committee	Provision of water services
Kayahwe	Kahuti	Kangema and surrounding areas	Stakeholders (dominated by county government)	Board of directors (usually 9)	Provision of water and sewerage services
Mathioya	Muranga South	Kigumo, Kandara, Maragwa,	Stakeholders (dominated by county government)		Provision of water and sewerage services
Amboni/ Muringato	Nyeri WSC	Nyeri, Chaka, Kiganjo	Stakeholders (dominated by county government)		Provision of water and sewerage services
Sagana	Nyeri WSC	Nyeri, Chaka, Kiganjo and surrounding areas	Stakeholders (dominated by county government)		Provision of water and sewerage services
Rwamuthambi	Kirinyaga WSC	Kerugoya, Kutus, Wanguru, Sagana	Stakeholders (dominated by county government)		Provision of water and sewerage services
Nyamindi	Gichugu	Gichugu	Stakeholders (dominated by Community		Provision of water services
Ruguti	Nithi	Chogoria, Chuka and surrounding areas	Stakeholders (dominated by county government)		Provision of water and sewerage services
Mara	Nithi	Chogoria, Chuka and surrounding areas	Stakeholders (dominated by county government)		Provision of water and sewerage services
Iraru	Imetha	Nkubu, Timau, Kayaking, Tigania, Maua, Mitunguu, Mwimbi, Gituma, Katimiki	Stakeholders (dominated by county government)		Provision of water and sewerage services
Mariara	Imetha	Nkubu, Timau, Kanyekini, Tigania, Maua, Mitunguu, Mwimbi, Gituma, Katimiki	Stakeholders (dominated by county government)		Provision of water and sewerage services
Ura	Tuuru	Lare	Catholic Church	The Church	Provision of water services

Source: Tana Water Services Board and water companies/ Water Users Associations

3.2.3.4 Registration of WUAs with WRUAs

The membership of Water Resources Users Associations is usually the internal and external stakeholders. The internal stakeholders include water abstractors. The Water Resources Users Associations are authorized to be part of water permitting process. Section 28 of the Water Resources Management Rules 2007 authorizes Water Resources Users Associations to comment on water use application through form WRMA003. Therefore all abstractors are automatically involved with the Water Resources Users Associations from the beginning. According to Water Resources Management Authority records, all operational and registered Water Users Associations are members of Water Resources Users Associations where they exist while all Water Users Associations interviewed explained that they were active members of Water Resources Users Associations unless the WRUA is yet to be formed. However there are some who are in the process of being members of WRUAs after the WRUAs are formed or as the WUAs get established hence the reason why membership of WRUAs change positively with time in most cases.

3.2.3.5 Wetlands, Springs, Dams, Hotspots (Degraded Areas)

Within the river basins, there are wetlands and springs which lead to streams and are the sources of rivers, while dams are there as storage to enhance availability of water. However due to population pressure, some areas of the catchments are degraded making them to be hotspots and impact negatively to the good health of the river systems.

Wetlands: According to the Environmental Management and Coordination Act 1999 are simply defined as areas permanently or seasonally flooded by water where plants and animals have become adapted. Wetlands vary in sizes and big wetlands are usually found in relatively flat areas. Wetlands in the river basins were geo-referenced.

Springs: ASpring as defined in the Water Act 2002 is water emerging from beneath the surface of the ground other than as a result of drilling or excavation operation. Springs are the major sources of water for rivers especially when it is not raining in the catchment (When it is not raining and the rivers are flowing, the flow is groundwater). There are more springs in the upper part of most catchment areas and usually in the wet areas as compared to the dry areas. Springs in the river basins were geo-referenced.

Dams: Dams are structures put across a channel to impound water for storage to enhance availability of water and any other use like flood control. Dams of reasonable sizes are usually put up at areas of good dam sites. Dams are major source of water for some water supplies and are used for other purposes like fishing and recreation. The dams are there to take care of water balance within the catchment especially storage during floods and availing water during drought.

Table 3.24: Geo referenced major dams

Dam	River basin	Geo reference
Sasumua	Lower Chania/Sasumua	-0.7556 36.6710
Ndakaini	Thika	-0.8191 36.8377
Masinga	Thika/ Tana	-0.8420 37.3420
Kamburu	Thiba/Tana	-0.83054 37.6476
Gitaru	Thiba/Tana	-0.7894 37.7442
Kindaruma	Ena/Tana	-0.8123 37.8020
Kiambere	Ena/Tana	-0.6784 37.8999
Chinga	Gura	-0.5866 36.9168

Source: Data from GIS expert

Hotspots (degraded areas): Due to population pressure, human activities and poor land use, some areas have become hotspots due to degradation. Most of these hotspots are in hill tops, quarries, river banks and poorly managed farms. These areas are major source of sediments which impact negatively in the siltation of rivers, dams, water pollution and reduction of soil fertility plus ground water recharge reduction within the catchment.

During the baseline study, wetlands, springs, dams and hotspots were identified mostly through the field visits while collecting data from households. The local community members of the households informed the enumerators about the hotspots and these were geo-referenced.

Conservation and Protection: Springs and wetlands need to be protected as sources of the rivers by using WRUAs as the lead agents in the exercise. However in some cases, the springs and wetlands have been interfered with especially through destruction of the vegetation within them, cultivation, drainage and planting of unfriendly trees which usually dry up the springs and the wetlands. An example within the Upper Tana is that Nyeri County which has 13 protected springs and 68 unprotected springs according to the County Integrated Development Plans while Kirinyaga has 29 unprotected springs as per the County Integrated Development plan.

One of the biggest challenges is the ownership of the land within which the wetlands and springs are situated. When they are privately owned, the challenge is when the owner decides to destroy springs or the wetland. Protection of springs and wetlands within private

property is not easy when the owner is not willing to cooperate. Also, when it is public and the stakeholders do not see it as an important spring or wetland, it can be a challenge though in such a case, the stakeholders can be sensitized and informed leading to protection and conservation.

Dams are either public or private and challenges are on its use and maintenance especially due to activities upstream. The conservation of their catchments needs to be done while using WRUAs as lead agent. The major challenges for dams are siltation and pollution. The poor management of farms upstream and the resultant erosion due to runoff, deposits the silt downstream and usually in river channels and dams. The control of these activities in privately owned land is a challenge due to willingness of the owners and their attitude towards the protection of the structures downstream. Some of the major dams include Hombe and Ragati, Sasumua and Ndakaini plus Chinga while Thiba and Maragua are proposed.

The hotspots in terms of degradation are usually due to poor land management. The destruction of vegetation cover, uncontrolled land use and poor soil and water conservation structures makes an area to become a source of sediments which lead to siltation. This is common in areas of higher population pressure and high levels of poverty. Some dam areas are hotspots and dams like Kiunyu, Kinguru and Gatuamba dams in Nyeri County are encroached hence hotspots according to WRMA sub regional office - Muranga.

When the Hotspots are privately owned, it is difficult to manage when the owner is not willing while public owned can be managed by stakeholders through fencing and putting in place conservation structures. WRUAs need to be involved in the conservation exercises.

Land use surrounding the wetlands, springs, dams and hotspots: Due to population pressure on land and scarcity of water with the unreliability of rainfall, destruction of the catchments and unplanned exploitation of the available resources is very common in upper Tana. People cultivate up to the eye of the springs leading to drying of the springs. The wetlands have been encroached and some are drying due to:

i. Poor land use
ii. Draining for cultivation
iii. Planting of trees which are unfriendly to water

Most of the hotspots are due to poor land use method like quarrying, cultivation without soil conservation measures, random destruction of vegetation cover and farming on river line areas.

Incentives to encourage the conservation of the wetlands, springs, dams and hotspots: The farmers produce for their consumption and selling to generate income. Any incentive should address these two issues while an informed community adapts things or ideas in a more sustainable manner. Therefore according to people and

institutions interviewed the most effective incentive to encourage conservation may include:

i. Empowering the farmers/ community with knowledge to ensure they know the importance and contribution of the wetlands, springs, dams and all parts of the catchment to the wellbeing of the river basins.
ii. Build capacity in the farmers/ community on the effective management of wetlands, springs, dams and hotspots.
iii. Provide better production methods to encourage use of smaller land size for maximum production to avoid further encroachment while looking for more land e.g. Irrigation projects using appropriate methods like drip.
iv. Fencing off the wetlands, springs, dams and hotspots to ensure no interference by the local community while the issue of ownership isaddressed.
v. Financing the activities of the community either through Water Resource Users Associations, Water Users Associations, or other organizations to reduce poverty, reduce dependence on subsistence agriculture and be busy with income generating activities.
vi. Using the new wetland policy, which calls for the enforcement of relevant laws and regulations that promote maintenance of ecological integrity of wetlands and ensures protection of water sources.

3.2.4 Main Water Pollution Sources

Pollution in relation to water resource is any direct or indirect alteration of the physical, thermal, chemical and biological properties of the water resource, making it less fit for any beneficial purpose or harmful to safety of human beings, other living things and the environment. Pollution sources produce pollutants which pollute the water resources. These include towns which produce liquid waste and solid waste, factories of beer, coffee, tea, soda, milk, and others which produce factory effluent etc., slaughter houses, sewerage ponds which produce effluent, and irrigation scheme plus farms which produce residual fertilizers and pesticide which pollute surface and ground water.

Within the water catchments areas, water resource is managed in terms of its quantity and quality. The water quality is affected by runoff which deposits its load into the rivers. There is also pollution by unmanaged industrial waste especially from towns, slaughter houses and factories, domestic waste which is discharged from settlements and institutions and solid waste usually from dump sites. The above are point source pollutants.

There are non-point pollutants especially fertilizers, pesticides and residues from irrigated area from both large and small scale agriculture.

Silt is another pollutant and usually from farmlands, roads, quarries, degraded areas. Upcoming markets and towns where solid and liquid waste is not managed well contribute

to pollution of water resources while linen washing (domestic washing) along rivers is another source of pollution.

During the baseline study the main water pollution sources were identified mostly through the field visits while collecting data from households. The locals/members of the households informed the enumerators about the nearby main water pollution sources and were geo-referenced.

Coffee factories which are common in the coffee zones of Mt. Kenya and Aberdares catchments are major sources of pollution because the effluent management plans are not effective and needs to be upgraded. The major towns within the UTaNRMP river basins are overwhelmed by the management of the solid and liquid waste hence leading to pollution of both groundwater and surface water. Not all areas in the towns are covered by the sewerage systems while there are leakage and overflow on sewerage manholes.

Within the Thika river basin, Thika town is a major source of pollution while Mathioya river basin has Murang'a town as one of pollution source. Ragati river is threatened by pollutants from Karatina town while Thiba river is threatened by pollutants from Kerugoya, Kutus and Wanguru towns plus Mwea rice irrigation scheme drainage. Murubara river has pollution challenge from slaughter house near Murubara bridge on Embu to Nairobi road and the Nice rice factory complex. Embu town threatens Rupingazi river with pollutants while Kithinu river is threatened by Nkubu town and Kathita river by Meru town. Ura river has pollution challenge from Maua town while the Mara river basin has pollution challenge from quarrying. The management of effluent from all factories, towns, markets and hotspots require urgent efforts to effectively put in place management plans to improve on the water quality within the river basins.

3.2.5 Water Supply Systems

The provision of water services are usually through water supply systems which target domestic or irrigation purposes. However there are water service providers for domestic while for irrigation water service no registered and regulated Irrigation Water service providers yet but Irrigation Water Services Users Associations exists. The water abstraction records from Water Resources Management Authority for each river basin was used to establish the type of water supply system, the ownership and type of the infrastructure as per their applications for water permits.

3.2.5.1: Ownership of Water Supply Systems

The water supply systems are either owned by a company, private entities or by individuals or communities.

Private water systems are the ones owned by an individual or a private entity like a limited company. The private water projects are limited to the number who can benefit from the

project hence not the best project to invest in for the benefit of the community at large. The companies owned water projects are run on behalf of the public in the area and are registered Water Users Associations (WUAs) with the service provision agreement between them and Water Services Board. These are the ones who have the legal mandate in terms of provision of domestic water services as per the Water Act 2002 hence supply treated water.

The individuals/ communities owned water projects are run for the benefit of that specific entity/ community though they do not have service provision agreement with the Water Services Board hence they are the unregistered Water Users Associations. Also the water projects by public institutions like schools, hospitals, churches and government department can benefit the public. It is illegal according to Water Act 2002 to supply water for domestic use in an area already covered by registered WUAs. However most community water projects have an irrigation component and operate within a WUA area of coverage. Irrigation is important in the current farming practices because of unreliable rains.

The Water Supplies have their intakes at rivers or boreholes and have Supply Systems to the consumers. Within Upper Tana, there are water supply systems by companies contracted by Tana Water Service Board and most target the towns like Nyeri, Embu, Meru, Karatina, Muranga, Thika etc. All of these are Government operated and managed and have the water treated. There are other water supply systems managed by communities/individuals. Most of these supply untreated water targeting water for both irrigation and domestic use.

3.2.5.2 Water Supply System Management and Infrastructure

The water companies have Board of Directors composed of representatives of the major stakeholders like the County Government, Consumers and Institutions within the area. The Community Water Project usually has management committee while those of Institutions and Individuals are managed by the Institutions or the Individuals.

Infrastructure: The infrastructure in the water projects are mostly piped water delivery systems with intake works. However three water furrow systems Mirurii in Iraru river, Karocho in Thingithu river and Ishiara in Thuci river were identified during the field visit.

Generally, most of the infrastructure has low efficiency because of poor maintenance. Wear and tear over time is common hence systems require replacement and upgrading. Due to this problem of infrastructure, the Unaccounted for Water (UFW) in some systems is as high as 60% which is high when compared to the national average of 45%. There is need to reduce the UFW to around 30% as per the goals of the National Water Services Strategy. The state of the infrastructure is worse in community water systems when compared to that of water companies and private firms.

There are some water supply systems which do not get adequate water to meet the demand due to availability of water like those abstracting from Kapingazi river hence relocating the

intake to other better water sources. Also, due to competing needs, the available water is not enough to meet the current and future demands hence the need to create storage in some river system like Nairobi, Kapingazi and Thiba rivers.

Water permits: As per Water Resources Management Authority (WRMA) records, river basin have records on the abstraction of water showing those with permits, authorizations and applications in the process. Most of those with applications in the process are legalizing the existing abstraction while those with authorizations are already using the water. However, according to WRMA, there is need to do abstraction survey in all the river basins to establish the real situation on the ground.

An abstraction survey done recently on Rupingazi river showed that over 100 illegal abstractions exist especially in the lower areas. Also during the field visits, people were aware of some illegal abstractions. Currently, some of the illegal abstractors are processing water permit applications. Some temporary intakes for Ishiara, Mirurii and Karocho leading to open canal systems were witnessed at Thuci, Iraru and Thingithu rivers respectively. The abstractions in each river basin were analyzed to establish the number of domestic water supply (those with no irrigation component) and number of irrigation water supply (those with irrigation component).

The source of water for abstractors is either groundwater or surface water. The abstractors were classified as company, community/ individuals and private.

Table 3.25 shows the summary of the water supply systems in each river basin showing how many are on irrigation, domestic and who owns the systems plus the water source.

Table 3.25: Water Supply Systems for MKEPP River Basins (Tributaries)

Category	River Basin	Source	No. of W/S	No. for Irrigation.	No. for Domestic.	No. for Company	No. for individuals/ community	No. for private	Water Permit
MKEPP River Basins (5)	Ena	Surface(S) Ground(G)	152 96	83 14	69 82	2 Nil	94 67	56 27	AP=19(S), 22(G) AU=93(S), 71(G) PE=40(S), 3(G)
	Kapingazi/ Rupingazi	Surface(S) Ground(G)	204 95	159 33	45 62	5 Nil	86 50	113 45	AP= 33(S), 27(G) AU= 116(S),55(G) PE=55(S),13(G)
	Kathita	Surface(S) Ground(G)	1599 171	1100 86	498 85	11 Nil	1507 142	81 29	AP= 267(S),54(G) AU= 946(S),106(G) PE=386(S),11(G)
	Kithinu/ Mutonga	Surface(S) Ground(G)	152 48	132 12	20 30	2 Nil	133 36	17 12	AP= 32(S), 16(G) AU= 77(S),30(G) PE=43(S),2(G)
	Tungu	Surface(S) Ground(G)	25	20	5	1	13	11	AP= 3(S) AU= 15(S) PE=7(S)

NB. W/S: Water Supply, AP: Permit application, AU: Authorization, PE: Permit *Source: WRMA records - March 2014*

Table 3.26: Water Supply Systems for UTANRMP Priority River Basins

Category	River Basin	Source	No. of W/S	No. for Domestic.	No. for Irrigation.	No. for Company	No. for individuals/ community	No. for private	Water Permit
High priority	Thika/ Sasumua	Surface(S) Ground(G)	438 360	55 260	383 100	8 -	63 167	367 193	AP= 92(S),87(G) AU= 214(S),238(G) PE=132(S),22(G)
	Saba Saba	Surface(S) Ground(G)	56 86	7 44	49 42	- -	8 34	48 52	AP= 9(S),23(G) AU= 32(S),63(G) PE=15(S),-(G)
	Maragua	Surface(S) Ground(G)	79 46	16 19	63 50	1 -	25 19	53 27	AP= 23(S),17(G) AU= 47(S),28(G) PE=9(S),1 (G)
	Nairobi	Surface(S) Ground(G)	35 46	1 19	34 27	- -	7 19	28 27	AP= 3 (S),17(G) AU=1 9 (S),28(G) PE=13 (S), 1(G)
	Ragati	Surface(S) Ground(G)	129 42	27 21	102 21	4 1	60 10	65 32	AP= 27(S),15 (G) AU= 69(S),24(G) PE=33(S),3(G)
	Thiba	Surface(S) Ground(G)	556 178	97 125	459 53	10 2	182 97	364 81	AP=80(S),59(G), AU=319(S),110(G), PE=157(S),9(G)
	Murubara	Surface(S) Ground(G)	49	2	47	-	10	39	AP= 8(S), AU= 25(S), PE=16(S),
	Rupingazi	Surface(S) Ground(G)	204 95	45 62	159 33	5 Nil	86 50	113 45	AP= 33(S), 27(G) AU= 116(S),55(G) PE=55(S),13(G)
	Thingithu	Surface(S) Ground(G)	37	9	28	2	31	4	AP= 6(S), AU= 23(S), PE=8(S),
	Thanantu	Surface(S)	22	8	14	1	19	2	AP= 7(S),

Category	River Basin	Source	No. of W/S	No. for Domestic.	No. for Irrigation.	No. for Company	No. for individuals/ community	No. for private	Water Permit
		Ground(G)							AU= 9 (S), PE=6(S),
	Thangatha	Surface(S) Ground(G)	5	2	3	-	5	-	AP= 1(S), AU= 2(S), PE=2(S),
	Rujiweru	Surface(S) Ground(G)	6	1	5	-	5	1	AP= 1(S), AU= 1(S), PE=4(S),

NB. W/S: Water Supply, AP: Permit application, AU: Authorization, PE: Permit

Source: WRMA records - March 2014

Table 3.27: Water Supply Systems for UTaNRMP Other River Basins

Category	River Basin	Source	No. of W/S	No. for Domestic.	No. for Irrigation.	No. for Company	No. for individuals/ community	No. for private	Water Permit
Others River Basins	Lower Chania	Surface(S) Ground(G)	40 64	13 42	27 22	1 -	27 16	12 48	AP= 3(S),11(G) AU= 19(S),44(G) PE=18(S),9(G)
	Kayahwe	Surface(S) Ground(G)	20	2	18	-	4	16	AP= 6(S), AU= 13(S),PE=1(S),
	Mathioya	Surface(S) Ground(G)	36 41	12 13	24 18	2 1	13 27	21 13	AP= 12(S),14(G) AU= 18(S),26(G) PE=6(S), 1(G)
	Amboni/ Muringato	Surface(S) Ground(G)	74 48	8 17	66 31	- -	29 17	45 31	AP= 14(S),16(G) AU= 28(S),31 (G) PE=32(S), 1(G)
	Sagana	Surface(S) Ground(G)	85	9	76	-	49	36	AP= 19(S), AU= 53(S), PE=13(S),

Category	River Basin	Source	No. of W/S	No. for Domestic.	No. for Irrigation.	No. for Company	No. for individuals/ community	No. for private	Water Permit
	Rwamuthambi	Surface(S) Ground(G)	153 49	29 23	124 26	3 -	81 14	69 35	AP= 22(S),17(G) AU= 68(S),31 (G) PE=63 (S), 1(G)
	Nyamindi	Surface(S) Ground(G)	173 22	57 15	116 5	- -	52 8	121 12	AP= 36(S),5 (G) AU= 83(S),16(G) PE=54(S),1 (G)
	Ruguti	Surface(S) Ground(G)	7	1	6	-	6	1	AP= 1(S), AU=6(S), PE=-(S),
	Mara	Surface(S) Ground(G)	7	1	6	-	5	2	AP= 2(S), AU= 5(S), PE=-(S),
	Iraru	Surface(S) Ground(G)	11	4	7	-	9	2	AP= 5(S), AU= 6(S), PE=-(S),
	Mariara	Surface(S) Ground(G)	67	13	54	-	52	15	AP= 8(S), AU= 39(S), PE=20(S),
	Ura	Surface(S) Ground(G)	8	2	6	-	6	2	AP= 3(S), AU= -(S), PE=5(S),

NB. W/S: Water Supply, AP: Permit application, AU: Authorization, PE: Permit

Source: WRMA records - March 2014

There are about 41 surface water abstractions used by about 25 contracted WUAs by Tana Water Service Board while about 2667 community water supply systems abstracting from surface water are potential WUAs which can be contracted/ registered. However, the service board has conditions to be fulfilled before a WUA is contracted/ registered to supply water as per the law. The big water projects can be registered alone while the small ones can be put together under one company for registration.

3.2.6 Households with Safe Drinking Water

Water supply systems for domestic water may supply treated water or untreated water. Safe drinking water is usually the treated water. The coverage of the population by safe drinking water within an area is high in towns than in the rural areas. Sometimes the households are connected to the water supply directly though there are other cases where household access water from common water kiosks.

Safe Drinking Water is usually effective treated water and usually goes through all the necessary processing which includes filtration and chlorination before delivery to the consumers.

Most companies provide treated water while most community water projects supply water which is not pre-treated effectively hence the consumers need to pre-treat through boiling before drinking. There are cases where consumers are connected to a water supply though the water is not safe for drinking.

Table 3.28 gives the percentage of households with safe drinking water based on information obtained from households during the household survey.

Table 3.28: Households with Safe Drinking Water

River Basin	Households with safe drinking water (%)	Household members of water project (%)
Ena	18	44
Rupingazi/Kapingazi	17	48
Mutonga tributaries	62	12
Kathita tributaries	0	31
Thika/ Sasumua	37	11
Saba Saba	22	12
Maragua	15	23
Nairobi	35	58
Ragati	26	78
Thiba	18	25
Murubara	3	48
Rupingazi	17	48
Thingithu	78	23

River Basin	Households with safe drinking water (%)	Household members of water project (%)
Thanantu	19	65
Thangatha	3	47
Rujiweru	4	75
Lower Chania	45	73
Kayahwe	37	67
Mathioya	37	76
Amboni/Muringato	42	46
Sagana		
Rwamuthambi	46	58
Nyamindi	8	
Ruguti	57	23
Mara	56	34
Iraru		
Mariara	26	52
Ura	4	75

Source: Field data - 2014

On average, 46% of the households interviewed are connected to a water project while 28% have safe drinking water. This translates to 2.392 million people connected and 1.456 million with safe drinking water out of the 5.2 million population in the whole project area. The project however targets households 250,000 (1,025,000 persons) within the river basins. Using the same percentages for the target population, this translates to 94,300 households (471,500 persons) connected to piped water and 57.400 households (287,000 persons) with safe drinking water.

3.2.7 Area under Irrigation

The major water use in Kenya is irrigation and irrigation uses 70% of the total water demand in Kenya. There are irrigation schemes which are small while others are medium or large scale. Irrigation schemes are either household based or scheme based. The household based projects target certain acreage per household though the irrigated area is usually fluctuating especially when households change their plans on which crops to plant. However scheme base irrigation project can maintain the area under irrigation and the crops grown because there is a central decision making system which is not individual based like the household targeted irrigation.

The Irrigation Schemes have plots allocated to individuals, while those targeting households have varying sizes of land but targeting an average size of land for irrigation for each household.

The information in table 3.29 is from the WRMA abstraction data base while table 3.30 is from data which was collected during the Household survey exercise.

Table 3.29: Area under Irrigation (Ha)

River Basin	Permitted Area for Irrigation (Ha)
Ena (4EC)	108
Rupingazi/ Kapingazi (4DC)	256
Mutonga tributaries (4EA)	284
Kathita tributaries (4FA)	1710
Thika (4CB)	5846
Saba Saba (4BF)	48
Maragua (4BE)	11
Nairobi/ Sagana (4AA)	1336
Ragati (4BB)	477
Thiba/ Murubara (4DA)	5380
Thangatha (4FB)	169
Lower Chania (4CA)	268
Mathioya (4BD)	4
Amboni/Muringato (4AB)	150
Rwamuthambi (4BC)	385
Nyamindi (4DB)	94
Thuci/ Ruguti/Mara (4EB)	443
Ura/ Rujiweru (4FC)	111

Source: WRMA Abstraction/ Permit Data Base May 2014

The WRMA abstraction data base was used to establish the area under irrigation per river basin. The abstraction data base ha three categories of data. There are proposed abstractors who are either having their applications being processed or those given authorization to put in place works (intake and delivery lines). The other abstractors are the ones with water permits which allow them to abstract water after inspection of the works to ensure they meet all the WRMA conditions.

Therefore the irrigation abstractors with water abstraction permits according to WRMA abstraction data base were targeted to establish the irrigated areas in the river basins because they are the legal abstractors.

Table 3.30: Percentage of People Engaged in Irrigation and Technologies used

River Basin	Those who do Irrigation (%)	Those on Overhead (%)	Those on Bucket (%)	Those on Drip (%)	Those on others (%)
Ena	30	30	23	0	47
Rupingazi/ Kapingazi	53	43	4	6	47
Mutonga tributaries	75	59	3	0	38
Kathita tributaries	15	45	0	0	55
Ena	30	30	23	0	47
Rupingazi/ Kapingazi	53	43	4	6	47

River Basin	Those who do Irrigation (%)	Those on Overhead (%)	Those on Bucket (%)	Those on Drip (%)	Those on others (%)
Mutonga/ Kithinu (Thuci)	75	59	3	0	38
Kathita (Ngaciuma)	15	45	0	0	55
Thika/ Sasumua	15	0	7	0	93
Saba Saba	15	0	15	5	80
Maragua	10	0	18	6	76
Nairobi	65	58	12	5	25
Ragati	57	23	9	9	59
Thiba	40	18	7	14	61
Murubara	66	23	25	19	33
Thanantu	65	58	12	5	25
Thangatha	33	23	3	0	74
Rujiweru	33	38	17	4	41
Lower Chania	24	8	20	0	72
Kayahwe	15	4	22	0	74
Mathioya	15	4	22	0	74
Amboni/Muringato	38	28	0	0	72
Rwamuthambi	38	19	11	4	66
Nyamindi	58	50	8	8	34
Ruguti	35	20	15	5	60
Mara	67	14	45	6	35
Iraru	50	75	25	0	0
Mariara	57	43	9	9	39
Ura	33	25	17	42	16

Source: Field data - 2014

Within the river basins of UTaNRMP, on average, 40% practice irrigation, while 29% use overhead, 12.6% use bucket, 5.5% use drip and 52.9% use others. Others may include flooding, pipe, canal etc.

However the Households and key informers interviewed did not at that time have figures on the size of land under irrigation or under any method of irrigation. It was a challenge to have well-kept irrigation records.

3.2.8 Summary Findings

The baseline study of Upper Tana has considered the water resources issues in river basins of UTaNRMP and established that:

i. There are sub catchments where WRUAs need to be formed (22 WRUA are at proposed stage).
ii. There are WRUAs who need to develop SCMP (15 WRUAs are just formed).

iii. There are activities in existing SCMPs by WRUAs (18 WRUAs with SCMPs ready for implementation) which need to be implemented.
iv. There are areas not effectively covered by WUAs (22 areas have WRUAs proposed).
v. There are 76 (abstracting over 1000m3 per day)large community water projects not registered as WUAs by WSB
vi. All registered WUAs are effective members of WRUAs.
vii. There are fewer households connected with safe drinking water than those connected to water (28% of households connected to safe drinking water while 72% are not).
viii. There are fewer households (5.5%) practicing effective irrigation methods like drip.
ix. Poor record management in the irrigation sector especially household irrigators.
x. There are 83 (7 registered and 76 large but unregistered water projects) with inefficient water supply systems with Unaccounted for Water is higher than 45%.
xi. There are about 20% water supply systems which do not get sufficient water from the current source to meet their demand e.g., those on Kithinu and Mariara rivers.
xii. There are 51 identifiedencroached and unprotected springs, wetlands and hotspots (degraded).
xiii. There are 44 identified poorly managed sources of water pollution.
xiv. There are more authorizations other than permits though the systems are operational as indicated in tables 4.10, 4.11, and 4.12 where authorizations (80%) are more than permits (20%) in each basin.
xv. There are 3 identifiedfurrow systems which waste water during delivery and application.
xvi. Abstractions which cluster can be put in common intakes especially in the strained rivers like Mariara, Kithinu, Thuci and Thiba rivers.

The established issues which are negative need to be addressed to ensure effective management of the water resources for appropriate use in domestic and irrigation plus any other water use like hydropower production.

3.2.9 Recommendations for Water Issues

There is need to ensure proper and effective management of water resources for the benefit of the community within the river basins.

Since poverty impacts negatively on the environment leading to destruction and poor management of resources, there is need to put in place activities to improve on livelihood to reduce poverty. Therefore there is need to:

i. Initiate formation of WRUAs in basin where there are none (22 WRUA are at proposed stage) to have a fora for catchment management.

ii. Some WRUAs need support to develop Scamp's (15 WRUAs are just formed) to identify issues to be addressed in the sub catchment.
iii. All WRUAs need support to implement activities of SCMPs (18 WRUAs with SCMPs ready for implementation) for effective water resources management.
iv. Support community water projects.
v. Register water projects with Tana Service Board so as to cover more areas and to connect more people with safe drinking water.The project can target 76 projects water projects which abstract over 1000 m3 per day and are not yet registered with the Service Board.
vi. The water supply systems needs to be rehabilitated to ensure efficiency in operations and reduce the unaccounted for water levels to 30%.
vii. The strained rivers in terms of water availability like Thiba, Thuci, Mariara and Kithinu need the intervention of creating storage for water availability.
viii. More irrigation schemes needs to be in place and rehabilitation of existing ones to ensure better livelihoods and more income to the community.
ix. Built capacity in the irrigation sector especially records management.
x. The 51 identified hotspots (unprotected and encroached wetlands and springs) need to be protected and conserved.
xi. The 44 identified main sources of pollution to water bodies need to be managed effectively through effective effluent management plans.
xii. The 3 identified water supply systems which have furrows needs to be converted to pipes for improvement of efficiency.
xiii. Water supply systems with authorizations need their works to be inspected and issued with water permitsas in tables 3.25, 3.26, and 3.27.
xiv. The river basins with many small abstraction points (as in tables 3.25, 3.26, and 3.27) need to put in few common intakes for effective management of the water resources.

All the river basins experience the issues established but river basins like Murubara, Thiba, Mariara, Kinyaritha and Kayahwe have major challenges on springs, wetlands and hotspots while Ena river basin needs to be targeted on WRUAs. Kathita river and Thiba river need to be targeted on common intake intervention. With the implementations of the recommendations, the water resources will be managed well and the water use will lead to better livelihood for the people of upper Tana catchment.

3.3ENVIRONMENTALCONSERVATION

3.3.1 Background

Despite its importance, the upper Tana catchment has experienced considerable land degradation and a drastic reduction of surface water availability during the dry season, and poor water quality during the wet season due to high silt loads. These same factors contribute to the persistently high levels of rural poverty. The high prevalence of rural poverty contributes to environmental degradation which in turn reduces sustainable livelihood opportunities; as well as creating negative environmental externalities including forest degradation, human-wildlife conflict, and reduced availability and quality of water to downstream users.

Fortunately however, there are a number of opportunities for improving rural livelihoods in ways that are also beneficial for the natural environment. Indeed, one of the main objectives of the project is the sustainable management of natural resources for provision of environmental services. Essentially the project will work with the custodians of natural resources in the Upper Tana providing them with a number of direct and indirect incentives to do things that are good for the environment, good for them, and from which other parties will also derive benefit. These include community forest associations among other groups.

3.3.2Community Forest Associations

The Forests Act, 2005, recognized the important role forest adjacent communities can play in co-management of forests through Participatory Forest Management approach. The PFM approach thus allowed for the formation of Community Forest Associations (CFAs), which are duly recognized and registered groups under the Societies Act with the Attorney Generals (AG) offices. CFAs are formed by communities living within 5 kilometers from the forest boundary, and sometimes around hills. Ordinarily, each forest station has one CFA.

To effectively co-manage the forests, a Participatory Forest Management Plan (PFMP) has to be developed and subsequently implemented through clear frameworks. The preparation of PFMP requires the active participation of Kenya Forest Service (KFS), CFA and other stakeholders. Once the PFMP is approved by KFS, the CFA's sign a Forest Management Agreement with the Kenya Forest Service (KFS) on how they will conserve and utilize forest resources for livelihood or cultural purposes.

On the whole, most CFA are constituted by Community Based Organizations (CBO) which is made up of several forest user groups, with the most common in the UTaNRMP being involved in:

i. Plantation Establishment and Livelihood Improvement Scheme (PELIS)
ii. Grazing
iii. Bee keeping
iv. Herbal medicines
v. Firewood collecting
vi. Tree nurseries
vii. Forest rehabilitation
viii. Forest protection scouts
ix. Ecotourism
x. Fish farming
xi. Energy Saving stoves
xii. Briquettes making
xiii. Village savings and credit
xiv. Solar fence maintenance
xv. Green houses
xvi. Drip irrigation
xvii. Water tanks supply
xviii. Chaff cutters supply
xix. Dairy goats
xx. Beads and basket making
xxi. Mountain climbing potters

The CBOs formed by the different user groups, and representing one or more villages, and sometimes a forest beat, then come together to form the umbrella CFA. In effect, the CFA is thus a de facto "umbrella" institution for the CBOs/user groups, mainly acting as a forum for coordination, discussion and information sharing while the CBOs/user groups continue their activities on the ground. All CFAs have 3 other committees other than the executive, namely procurement, finance, and monitoring. The executive committee of the CFA is usually formed by different persons who represent the various CBOs. On the other hand, the CBO executive committee is also constituted by the members of the various user groups. The CBOs and user groups are also registered with the Department of Social Development

CFAs have generally changed the relationship of the forest adjacent communities with the Kenya Forest Service. This is because, through the CFA, communities have been able to accrue direct and indirect benefits for the forests. The communities also feel they own the forest and talk of it as their resource. They are thus able to protect and conserve it.

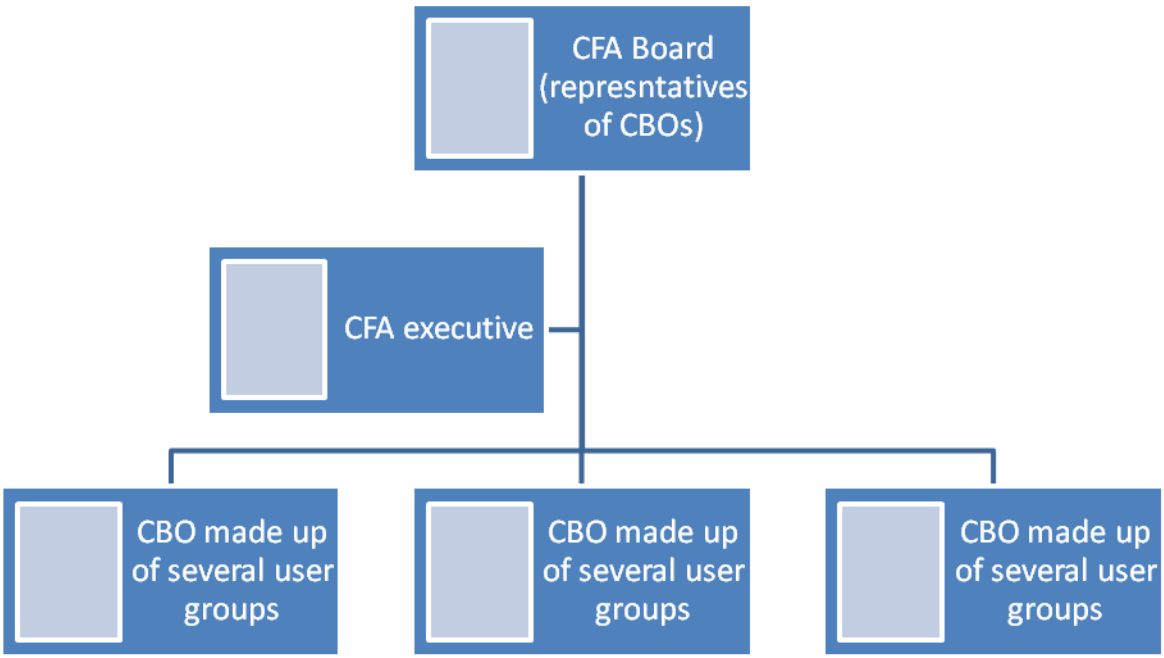
The CFAs also have their own constitutions and by-laws and are thus able to have proper codes of conduct for their members, all geared towards protecting and conserving the forest. Some of the CFAs have also undertaken the formulation of the Participatory Forest management Plans, and others even gone further to sign the management agreements with

KFS. Other CFAs are in the process of PFMP preparation, while some, especially those around hill tops are still in the registration process.

The CFAs have also benefitted from capacity building from various development partners and government agencies. Training has encompassed governance, proposals writing, financial management and reporting, business and financial skills. Some of the CFAs have also undertaken "*eye-opener*" field exchange visits to other CFAs to learn on how to best use the forest resources for their own benefit and that of the environment.

In the Upper Tana catchment, there are 39 CFAs formed (as of 30th March 2014) in the various forest stations and around some hills. The membership of the CFAs is varied with some having 1,000 members, while some go to as many as above 7,000 members e.g. Lower Imenti for the former and MEFECAP. The numbers of CBOs under each CFA also vary and range from 3 for Castle to 58 for Kangaita.

The general organization structure of the CFA is as shown below:



The main benefits of the CFAs is that they have been able to sustainably conserve and protect the environment, while at the same time accruing direct and indirect benefits to the forest adjacent communities. The benefits accruing to communities have transformed livelihoods. Some of the benefits that have been highlighted by CFA members include:

i. Increased incomes especially from PELIS and sale of tree seedlings. In Mucheene forest station for example, the CFA gets aver Ksh.70 million per season.

ii. Incomes from labour provided for tree planting in forest conservation and rehabilitation.
iii. Incomes from non-wood forest products like honey, and herbal medicines.
iv. Firewood.
v. Grazing.
vi. Alternative income sources through eco-tourism.
vii. Alternative incomes from non-forest based activities established from incomes accrued from forest based activities-this include green houses, honey (on farm hives), dairy goats, and fish farming.
viii. Improved markets for tree seedlings.
ix. Reduction of human-wildlife conflicts where solar wildlife barriers have been installed.

The Kenya Forest Service has also benefited greatly from the co-management and partnership arrangement of forest with adjacent communities allowed for under the Forest Act especially due to:

i. Establishment of plantations under PELIS.
ii. Rehabilitation of degraded indigenous forest areas.
iii. Improved relationship with communities who now feel they also "own" the forest;
iv. Reduced illegal activities as communities help protect forests by reporting any wrong-doers to the authorities.
v. Provision of forest scouts by CFAs.
vi. Increased availability of tree seedlings for forest conservation and on-farm trees planting.

The CFAs and their status along the UTaNRMP catchment are as follows:

Table 3.31: CFAs and Status in UTANRMP Catchment

ECOSYSTEM	COUNTY	No.	FOREST STATION	Name of CFA	Membership	Registration	Year of PFMP	Year of Management Agreement
Mt Kenya	**Embu**	1)	Njukiini East	Njukiini	600	2008	Being Developed	
		2)	Irangi	Irangi	1500	2008	2011	2014
		3)	Maranga Hill	Maranga	400	2012		
		4)	Kiangombe Hill	Kiangombe	500	2012		
	Tharaka Nithi	5)	Chuka	Chuka	1,200	2010		
		6)	Chogoria	Chogoria	1500	2008	2012	2012
		7)	Kiera Hill	Kiera	500	2012		
	Meru	8)	Ruthumbi	RUFECAP	7,000 7 CBOs	2010	2012	2014
		9)	Meru	MEFECAP (Meru Forest conservation and Protection Association	7,000 7 CBOs	2010	2012	2014
		10)	Lower Imenti	Lower Imenti CFA (LOIFECAP)	1,050 4 CBOs	2011	2012	2014
		11)	Mucheene	Kamulu(Kathita, Mucheene, Lugucu)	3,800 6 CBOs with 11 user groups each	2007	ongoing	
		12)	Marania	Marania	2,000	2010		
		13)	Ontulili	Ontulili	1800	2009	Draft form	
		14)	Ngare Ndare	Ngare Ndare Trust	1200	2006	2008	2010
		15)	Nyambene Hills	Nyambene (NYACOFA)	4,500 9 CBOs	2011	2012	2014
		16)	Ngaya	Ngaya	600	2011		
	Nyeri	17)	Nanyuki	Nanyuki	780	2009	2011	2014
		18)	Gathiuru	Gathiru	4000	2007	2011	2014
		19)	Narumoru	Narumoru	1500	2008	2011	2014
		20)	Kabaru	Kabaru	2000	2007	2009	2010
		21)	Hombe	Hombe	2,000	2008	2009	2010

ECOSYSTEM	COUNTY	No.	FOREST STATION	Name of CFA	Membership	Registration	Year of PFMP	Year of Management Agreement
					30 CBOs			
		22)	Ragati	Ragati	3700	2007	2012	2014
		23)	Chehe	Chehe	800	2008	2010 2014 - updated	2014
	Kirinyaga	24)	Kangaita	Kangaita	58 CBOs 4,680	2007	2010	2014
		25)	Castle	South Mt. Kenya Gitamata	5,232 3 CBOs – 82 user groups	2007	2011	2014
		26)	Kathandeini	South Mt. Kenya Ngariama	23 CBOs 3500	2007	2014	2014
		27)	Njukiini West	Njukiini West	3000	2007	2014	
		28)	Murinduko hill	Murinduko	800	2010		
Aberdares	**Nyeri**	29)	Kiandongoro	Kiandongoro	700	2012	2013	2014
		30)	Kabaru	Kabage	4500	2008	2009	2009
		31)	Muringato	Muringato	800	2010	2012	2014
		32)	Zaina	Zaina	1200	2008		
		33)	Zuti	Zuti	1500	2007	2012	2014
	Murang'a	34)	Kimakia	Kimakia CFA	2008	1,900 12 CBOs	2011	2012
		35)	Gatare	Gatare CFA	2006	1,500 30 CBOs	2011	2012
		36)	Karua	Karua CFA	2012	243 12 CBOs	2013	On process
(to be managed from Muranga to take care of Sasumua WRUA)		37)	Wanjerere	Wanjerere CFA	2007	2,000 10 CBOs	2012	2014
		38)	Kiambicho	Kiambicho CFA	2011	230 10 CBOs	2013	On process
	Nyandarua	39)	South Kinangop	South Kinangop	1200	2007	2012	2014

3.3.3 Environmental Hot Spots

Environmental hotspots in the agricultural lands in the Upper Tana catchment occur and manifest themselves in different forms, with the most common on-farm form of environmental degradation being soil erosion. Other hotspots are quarries, wetlands, swamps, hilltops, riverbanks, roadsides, towns and small urban centres, tea and coffee factories, and some landslides prone areas.

Soil erosion: This is the main environmental concern in agricultural lands and occurs due to intensification of agriculture, lack of conservation agriculture, leaving of soils bare, and farming on steep slopes without the prerequisite soil and water conservation structures. Soil erosion manifests itself through loss of topsoil and subsequent low fertility and low agricultural yields; occurrence of gullies; and significant sedimentation of water bodies downstream of agricultural areas. Other than where large gullies occur, soil erosion is a diffuse form of environmental degradation but is still wide spread e.g. the agricultural officer for Murang'a County estimated that 70% of agricultural land is degraded. Erosion is however more prevalent in the middle zones, especially in the coffee growing zones. Steep slope in the upper zones also contribute to significant erosion e.g. Nithi in Tharaka/Nithi and Kangema in Murang'a.

Another form of soil erosion is collapsing of river banks due to farming in the riparian areas. Sedimentation of rivers also results from this activity. Additionally, eutrophication of water bodies by fertilizers which end up in the water bodies also occurs. Pollution from pesticides used in agriculture is also prevalent.

Grazing areas especially near livestock watering points are also prone to degradation, while sand harvesting in rivers also leads to both pollution and land degradation including collapse of river banks. In Murang'a County, there were even reports from NEMA of forests being burnt so that sand would flow down the rivers. Wind erosion is also prevalent in the lower zones of river catchments.

Plates 3.1 Collapse of river bank – R. Murubara

Plate 3.2: Soil erosion in lower Thiba

Plate 3.3: Roofs blown by wind

Plate 3.4: School building after roof was repaired

Table 3.32: Land Degradation and Erosion Hot Spots in UTaNRMP

River Basin	Areas of Erosion/Degradation	GPS coordinates
Ena- Thuura tributary	Thura river sand harvesting zone	S 00 37.549 E 037 39.809
Ena- Thuura tributary	Thura collapsed River bank	S 00 38.024 E 037 39.975
Ena- Thuura tributary	Kiamugu primary school	S 00 37.426 E 037 39.347
Iraru	Gulley Near Nkurumo Blessed Academy, in Mururii - The gulley is caused by runoffs from the hill, is threatening to erode the road-requires culverts	0.1434554^0S 37.654969^0E
Iraru	Furrow intake made using sand bags - The intake has been destroyed by rains, requires reinforcement or construction of a new	0.138138^0S 37.652838^0E
Kayahwe	Murai primary school area	S 00 74.898 E 037 02.148
Kayahwe	Kiumu primary school area	S 00 74.857 E 037 00.385
Maara	Kajiundithi High Sch.	S 00 16.146 E 039 38.925
Maara	Kagaini tea buying centre	S 00 15.717 E 037 38.213
Maara	Gulley erosion	S 00 27.600 E 037 78.252
Maara	Ikumbo primary school	S 00 26.292 E 037 75.330
Maragua	Degraded hill - Gacharagua area - Rocky hill, naked without tree cover, subsistence farming on the hill, water springs beneath it, a lot of logging, power saws spotted	37 M 0273804 UTM 9914500
Maragua	Gacharagua area – serious erosion	37 M 0274730 UTM 9914329
Maragua	MUWASCO water pipe breathers, erosion spot	37 M 0282630 UTM 991445
Mariara	Abathoguchi sec school	S 00 01.723 E 037 64.794
Mathioya	Gully erosion – Gakuyo area	S 00 64.103 E 037 04.942
Mathioya	Kabui primary school	S 00 64.797 E 037 06.641
Mathioya	Gullies – Gaturi area	S 00 65.425 E 037 009.863

River Basin	Areas of Erosion/Degradation	GPS coordinates
Murubara	Murubara bridge	37 M 0317694 UTM 9928418
Nithi	Degraded area	37 M 0349748 UTM 9968901
Nithi	Degraded area with steep slopes, some people have done fanya juus but they do not seem to help much	37 M 0353522 UTM 9968662
Ragati	Kibingoti chief's office	S 00 33.942 E 037 11.358
Ragati	Confluence of Ragati and Tana	S 00 39.832 E 037 11.840
Ragati	Gulley soil erosion (Kibingoti)	S 00 33.920 E o37 11.446
Ragati	Gulley erosion at Mururiini	S 00 34.891 E 037 11.222
Ragati	charcoal burning near the place JKUCAT tissues culture centre	37 M 0297895 UTM 9941036
Ragati	Kamoni seasonal river meeting point with river Maragua where there is MUWASCO washout, water downstream becomes very dirt after this point	37 M 0282159 UTM 9914433
Ruji weru	Mukuiro dam	N 00 25.373 E 037 83.868
Ruji weru	Ntwene Primary & Sec. sch.	N 00 15.944 E 037 59.009
South Maara	Gulley erosion Kajiundithi High Sch.	S 00 16.099 E 037 37.980
Thanantu River	Gulley erosion, Kwamuthiatu	0.1856^0S 38.0281^0E
Thangatha	Irindiro Sec. School	N 00 09.303 E 037 52.521
Thangatha	Gikuri	N 00 08.845 E 037 52.715
Thiba	Makindu	S 00 44.145 E 037 28.172
Thiba	Githoboto (cattle drinking water area)	S 00 43.276 E 037 27.767
Thiba	Githoboto (gulley erosion)	S 00 43.289 E 037 27.792
Thiba	Erosion spot	37 M 0331185 UTM 9918965

River Basin	Areas of Erosion/Degradation	GPS coordinates
Thiba	Erosion spot	37 M 0338941 UTM 9919051
Thiba	Erosion spot	37 M 0329966 UTM 9918452
Thiba	High winds – erosion - School roofs blown off. Little tree cover	-0.74005/37.49557; -0.74785/37.49352
Thiba River	Gulley erosion	-0.5670 37.3233
Thura River	River Bank Erosion in Thura River in Mbeere	-06260 37.6636

Landslides: These are a form of serious soil erosion. They are more prone on steep slopes and usually happen after heavy rains, where soils, which have gradually been eroded, are unable to hold together any more leading to earth movement. Areas that are prone to landslides in the Upper Tana project area include the upper catchments of the Nairobi river basin in Nyeri county; and Maragua, Mathioya and Kayahwe rivers Murang'a county. Some of these areas have Eucalyptus trees planted which help hold the soils together, and when they cut them down, they experience landslides, and have thus opted to leave them altogether.

Quarries: These fall under two categories, those which mine stones and ballast, and those which mine murrum. These also occur in agricultural lands with most of them being in private land and next to rivers. The main environmental challenge of these quarries is that they are point sources of pollution, they degrade the environment, and they are rarely rehabilitated after exploitation of the resources, leaving them as eye sores, and sources of pollution and scenes of accidents as pits are left open and so are some man-made cliffs. Quarries are also areas of social concern especially with regards to early pregnancies, HIV/AIDS transmission, and employment of school-age children. Since there are no sanitary facilities at quarries, people also relive themselves in bushes.Quarrying is also a health hazard to the surrounding communities especially during the rainy seasons posing both landslides dangers to the populace and breeding sites for mosquitoes.






Plates 3.5 – 3.10: Quarry activities in Thingithu river basin

Table 3.33: Quarries and Mining Sites in UTaNRMP

County/ River Basin	Name of Quarry/Area	GPS coordinates
Ena - thuura	Kageeri Quarry	S 00 33.687 E 037 38.688
Honi River	Quarries	0.37.34 36.9963 0.3622 36.9959
Maragua	Murrum quarry for Nyeri-kabati road	37 M 0275335 UTM 9914380
Mariara	Angara quarry: Several quarries in this areas, with sand being deposited into the river	S 00 01.864 E 037 62.291
Mariara	Mariene quarries	37 M 0357428 UTM 9996996
Mariara	Mariene quarries: big quarry with the use of mechanized works, pollution spot since the outlet is to the river,	37 M 0356236 UTM 9996753
Mathioya	Gaturi area	S 00 65.023 E 037 08.248
Nairobi	Kiganjo quarry	
Nairobi	Mathina area	
Nairobi River	Quarries	0.3924, 37.0161
Ragati	Shamrock quarry	S 00 35.258 E 037 11.521
Thanantu River	Kawethu Bridge-Eroded, Sand harvesting, Car wash	0.1844 ^{0}S 38.0281^{0}E
Thiba	Seasonal stream and sand harvesting spot	37 M 03301140 UTM 9918648
Thika River	Quarries on the lower thika area	1.0257 37 0750, 1.0490 37.1377, 1.0453 37.1172
Thingithu	Quarry in Ikuu Location Thingithu River	37 M 0349655 UTM 9994839
Ura	Fish Pond, Quarry-mbooni tributary for Ura	0.241387^{0}N 37.921225^{0}E

Wetlands and springs: In the Upper Tana Catchment most springs are generally located at the fringes of forest areas and isolated hills while wetlands are in the upper and middle zones of the river basins. Most wetlands, floodplains and riparian areas have been converted into small holder agricultural land throughout the catchment. The challenge is mainly in the rice growing areas where virtually all large and small wetlands (e.g. Kimorori in Kirinyaga) have been put under rice growing. Indeed, instead of being the '*lungs of the earth'* by performing their

cleansing functions of water, wetlands have become points of pollution, polluting ground and surface due to pesticide and fertilizer use in agriculture.

Some wetlands in the catchment are also targeted for clay and brick making. They are thus drained to get the clay. Some of this is done commercially with wetlands in Maragua and Mukurweini areas especially targeted to mine clay which is used for manufacturing tiles and chinaware commercially.

Plate 3.11: Wetlands converted for rice growing in Murubara basin

Plate 3.12: wetlands converted for rice growingin Rwamuthambi basin

Plate 3.13: Eucalyptus planted to drain wetlands

Plate 3.14: Water pumps connected toelectricity for pumping water near Kagio – Rwamuthambi basin

Table 3.34: Wetlands and Springs in Upper Tana Catchment

River Basin	Unprotected Wetlands and Springs	GPS coordinates
Ena	Spring in Itimbogo	
Iraru	Unprotected Spring in Kanyuru, Gweru	37 M 0357670 UTM 9981542
Iraru	Unprotected Spring in Kithandika, Gweru	37 M 0357979 UTM 9981451
Iraru	Furrow	0.150186^0S 37.664774^0E
Kathita – kinyaritha	Kinyaritha wetland - Within national park	N 00 07.008 E 037 42.049
Kathita – kinyaritha	Kibukona wetland	N 00 06.510 E 037 42.193
Kathita – kinyaritha	Kibukona 2 wetland	N 00 06.288 E 037 42.256
Kathita – kinyaritha	Nguru 1 wetland	N 00 06.076 E 037 42.208
Kathita – kinyaritha	Nguru 2 wetland	N 00 06.028 E 037 42.046
Kathita – kinyaritha	Ithuru wetland	N 00 05.984 E 037 41.922
Kathita – kinyaritha	Nguru spring	N 00 06.467 E 037 42.279
Kathita – kinyaritha	Nguru 2 spring	N 00 06.049 E 037 42.112
Kayahwe	Kanginga wetland - Very large wetland, agriculture ongoing and wetland starting to dry up	S 00 74.916 E 037 00.021
Kayahwe	Kanginga spring	S 00 74.906 E 037 00.042
Kayahwe	Gathina spring	S 00 75.150 E 037 02.438
Kayahwe	Kahatia wetland	37 M 0269652 UTM 9918876
Kayahwe	Muriranjis wetlands	37 M 0273648 UTM 9917706 37 M 0276380 UTM 9917126
Kiiye	Kiiye wetlands - Big wetland covering about 20ha but heavily encroached. there is also a spring within the wetland next to the road and it is not protected	37 M 0324163 UTM 9950934
Kiiye	Kiiye wetlands - Spring conserved by the	37 M 0323737

River Basin	Unprotected Wetlands and Springs	GPS coordinates
	WRUA, trees are planted around it but now members of the WRUA feel the spring is in danger since people have begun cultivating around it	UTM 9950842
Kiiye	Kiiye wetlands	37 M 0325187 UTM 9950406
Kinyaritha	Kinyaritha wetland - Heavily encroached and farming activity going on, there is also a stream	37 N 0351925 UTM 0010075
Kinyaritha	Kambiti wetland	37 N 0353737 UTM 0009918
Kinyaritha	Kinyaritha wetland - Large but heavily encroached	37 N 0353286 UTM 0009959
Kinyaritha	Wetland and spring- Locals say the wet land had so many springs in the past but most of them have now dried up due to human activity especially cultivation within the wet land. Now only two springs remain within the wet land:	37 N 0353877 UTM 0010223
Kuuru	Kamaruki Swamp	0.75231^0N 37.769598^0E
Kuuru	Kamaruki Spring	0.100380^0N 37.754191^0E
Kuuru	Wetland Farming - The spring has been encroached, and communities started farming after they got a borehole	0.109169^0N 37.762038^0E
Kuuru	Wetland with eucalyptus-mailu area - privately owned	0.04929^0N 37.782463^0E
Maara	Kiamboli wetland	S 00 15.862 E 037 38.366
Maara	Kaaria spring	S 00 15.791 E 037 38.366
Maara	Kaaria spring 2	S 00 16.116 E 037 37.769
Maragua	Springs - Kahuro area	37 M 0273643 UTM 9914478
Maragua	Springs - Kahuro area	37 M 0273701 UTM 9914625
Maragua	Springs - Kahuro area	37 M 0273805 UTM 9914607
Maragua	Proposed dam for Nairobi water supply - People awaiting compensation.	– 0.719991 36.871957

River Basin	Unprotected Wetlands and Springs	GPS coordinates
	Resettlement Action Plan undertaken	
Maragua/Sagana	Iruri wetland - Fairly large wetlands, needs fencing	
Mariara	Tambanjuku wetland - Eucalyptus trees planted at this area to drain wetland	S 00 01.919 E 037 62.020
Mariara	Anjara wetland	S 00 01.872 E 037 62.269
Mariara	Angara wetland	S 00 01. 860 E 037 62.782
Mariara	Mariene wetland	S 00 01.796 E 037 62.824
Mariara	Tambanjuku spring	S 00 01.962 E 037 62.034
Mariara	Mariene spring	S 00 01.879 E 037 62.721
Mariara	Ruaruaro wetland	37 M 0352853 UTM 9995877
Mariara	Rurie - Large wetland that needs protection	
Mathioya	Kenugu wetland	S 00 64.948 E 037 08.248
Mathioya	Gaturi wetland	S 00 65.438 E 037 10.089
Mathioya	Gathairo	S 00 65.601 E 037 10.338
Mathioya	Gaturi spring	S 00 65.411 E 037 09.977
Mathioya	Kamacharia	37 M 02775136 UTM 9933397
Mathioya	Kirurumo	37 M 0276198 UTM 9932843
Mathioya	Mugeka wetland	37 M 0288592 UTM 9927904
Murubara	Wanguru dam (NIB)	S 00 40.770 E 037 22.119
Murubara	Gachore wetland	S 00 28.199 E 037 22.131
Murubara	Gachore spring	S 00 28.199 E 037 22.131
Murubara	Gatoe spring	S 00 28.305 E 037 22.133
Murubara	Kavoe spring	S 00 28.702

River Basin	Unprotected Wetlands and Springs	GPS coordinates
		E 037 21.831
Murubara	Kariru spring	S 00 28.682 E 037 21.764
Murubara	Kimaitha wetland used for rice farming	S 00 59.146 E 037 24.482
Murubara	Thumaita wetland – used for rice farming	S 00 58.931 E 037 24.540
Murubara	Kiandagae spring	S 00 67.026 E 037 20.568
Murubara	Wetlands in mid Murubara – Ahiti Ndomba area - Area has many wetlands but most of them have a small coverage and are greatly encroached	37 M 0314979 UTM 9934691 37 M 0315937 UTM 9934750 37 M 0316879 UTM 9934730 37 M 0316915 UTM 9933931 37 M 0316700 UTM 9935773
Murubara	Wetland near St. Paul's primary school	37 M 0313418 UTM 9936025
Murubara	River Murubara waterfalls	37 M 0313252 UTM 9936885
Murubara	Wetlands around Murubara bridge-Wanguru	37 M 0303401 UTM 9936933
Murubara	Wetlands around Murubara bridge-Wanguru	37 M 0318528 UTM 9925977
Murubara	Wetlands around Murubara bridge-Wanguru - Large wetland but now converted into rice farming fields	37 M 0318204 UTM 9927185
Murubara	Dam for Kenyangeine water project (NIB):	37 M 0318454 UTM 9924982
Murubara	Water pan - Agriculture around pan and for livestock watering	-0.69962 37.41568
Murubara	Unprotected spring in Kianyaga town that feeds into Murubara	-0.4967 37.551
Nairobi River	Kamahuria Water Project, borehole - Spoilt, dysfunctional due management wrangles	0.242198 37.0678
Nithi	Nithi spring	37 M 0353610 UTM 9968654
Nithi	Kahuro springs - Many springs converting into Kahuro stream, farming along the stream	37 M 0349748 UTM 9968901
Nithi	Nithi wetlands - Many springs converting into Kahuro stream, farming along the stream, others converted them into bit	37 M 0349680 UTM 9968998

River Basin	Unprotected Wetlands and Springs	GPS coordinates
	latrines.	
Nithi	Nithi Wetland - heavily encroached and there is a stream flowing through the wetland	37 M 0353679 UTM 9968686
Nithi	Protected spring - Done by WRUA. well cemented, few trees planted around it	37 M 0349122 UTM 9969269
Nithi	Nithi spring - Spring and stream flowing down to Nithi river	37 M 0349640 UTM 9969608
Nyamindi	Kamwangi wetland - car wash next to the bridge	37 M 03210166 UTM 9950229
Ragati	Gitaga wetland – drained for agriculture	S 00 34.008 E 037 11.497
Ragati	Gathithi wetland	S 00 34.753 E 037 11.235
Ragati	Gitage spring	S 00 33.912 E 037 11.472
Ragati	Ihwagi spring – not protected	S 00 26.842 E 037 08.436
Ragati	Ragati dam	37 M 0294911 UTM 9959227
Ruji weru	Gethanja wetland	N 00 26.491 E 037 94.869
Ruji weru	Gethanja spring	N 00 15.902 E 037 56.929
Ruji weru	Mwambia swamp/spring –– 8 acres in private land but later transferred to be public and already demarcated by lands people. Need fencing, eucalyptus tree planted	0.220981 38.053138
Rupingazi	EWASCO water project dam	S 00 27.819 E 037 27.233
Rupingazi	Nthambo wetland	S 00 29.525 E 037 26.359
Rupingazi	Gathita spring	S 00 29.038 E 037 26.946
Rupingazi	Karatee spring	S 00 25.783 E 037 27.481
Rupingazi	Kuvokori spring	S 00 26.175 E 037 27.519
Rwamuthambi	Kiandagai wetland - Large wetland converted for rice farming	-0.59189 37.24611

River Basin	Unprotected Wetlands and Springs	GPS coordinates
Rwamuthambi	Thumaita wetlands - Large wetland converted to rice farming	-0.61581 37.25420
Rwamuthambi	Gitondo wetland - Large, about 200 acres. Several pump houses pumping water and with illegal electricity connection	-0.63971 37.24593
Rwamuthambi	Kagumo area wetland - Small wetland heavily encroached	37 M 0301709 UTM 9944599
Rwamuthambi	Chogaka wetland	37 M 0303697 UTM 9949421
Thangatha	Gathasa wetland	N 00 07.718 E 037 53.375
Thangatha	Kethare	N 00 07.854 E 037 53.204
Thangatha	Ganguthi	N 00 07.687 E 037 53.526
Thangatha	Gathima	N 00 07.732 E 037 53.376
Thiba	Makindu dam	S 00 44.399 E 037 27.906
Thiba River	Spring - Wetland farming encroaching on the spring	0.5880 37.3234
Thiba River	Extensive Rice farming on wetland in Mukagara	-0.5441 37.3295
Thika River	Bendor Coffee Estate, Dams, Wetlands	0.969554^0s 37 042672^0E
Thingithu	Passion Fruit Nursery and Group center	0.047928^0S 37.626689^0E
Thingithu	Karocho irrigation scheme (furrow)	-0.1109 37.8570
Ura	Muura - Very clean water	N 00 22.104 E 037 92.540
Ura	Muamba spring - Intake of murone water project	N 00 21.796 E 037 92.070
Ura	Mboones spring- Polluted by wastes from Maua town	N 00 23.174 E 037 93.988
Ura	Pollution point in Maua town, where mbooni tributary passes through town center, in front of Nyambene Catholic bookshop, adjacent to Fr. Sondat Teachers Training College	0.231885^0N 37.939818^0E

Towns and small urban centres: All the urban centres in the Upper Tana catchment are point sources of pollution to the water bodies. This is because they lack proper solid wastes disposal systems/sites. In Kirinyaga for example, NEMA officials intimated that there are no properly designated dump sites and that some had even been grabbed. In Meru town, dumping was being done in the forest area.

Other than Nyeri and Embu towns, none of the other towns or small urban centres have any sewerage facilities and thus end up polluting the water bodies. Interestingly, the sewerage systems in the said towns have also been mentioned as pollution sources.

Plate 3.15: & 3.16: Water pollution in RujiweruDownstream of Maua town

Plate 3.17: & 3.18: Water pollution in Thingithuriver basin

Plate 3.19: NYEWASCO sewerage ponds

Plate 3.20: Pollution around Kagio town

Table 3.35: Towns and Urban Centres in UTaNMRP Basin

River Basin	Hot spots	GPS Coordinates
Ena - thuura	Kamogo shopping centre	S 00 33.687 E 037 38.688
Ena - thuura	Itiira shopping centre	S 00 37.534 E 037 39.706
Kayahwe	Kahatia town	37 M 0269524 UTM 9918895
Kayahwe	Muriranjas District Hospital	37 M 0274520 UTM 9917524
Kayahwe/Maragua	Kahuro shopping centre	S 00 74.787 E 037 00.676
Kiiye	Githure shopping center	37 M 0323551 UTM 9950934
Maara	Weru shopping centre	S 00 16.122 E 037 38.284
Maragua	Matunguru shopping centre - - Mutunguru bridge, very steep from shopping center to the bridge and highly eroded	37 M 0273160 UTM 9914879
Maragua	Mericho shopping centre	37 M 0276952 UTM 9915783
Mariara	Kariene shopping center:	37 M 0351153 UTM 9995414
Mathioya	Gakuyo shopping centre	S 00 64.889 E 037 06.263
Mathioya	Kiriaini town:	37 M 0272409 UTM 9933302
Mathioya	Mugeka shopping center	37 M 0287744 UTM 9928671
Mathioya	Kamacharia shopping center	37 M 0277229 UTM 9932282
Murubara	Sewage at Wang'uru	S 00 41.186 E 037 22.272
Murubara	Kianyaga shopping centre	S 00 29.772 E 037 21.232
Murubara	Mucagara shopping centre	S 00 27.489 E 037 21.853
Murubara	Thumaita shopping centre	S 00 59.701 E 037 24.820
Murubara	Slaughter house	37 M 0317715 UTM 9928301
Murubara	Mwea prison - Sewers overflow to river	-0.69443 37.39551
Murubara	Ndiniriku village - high livestock population	-0.71354 37.2785
Murubara	Kiombo centre - End of WRUA, near confluence of Murubara/Thiba	-0.71756 37.46523

River Basin	Hot spots	GPS Coordinates
Murubaru	Kutus town	37 M 0314112 UTM 9937570
Nithi	Marima shopping center	37 M 0350566 UTM 9969677
Nyamindi	Kiamutugu shopping center	37 M 0320394 UTM 9948459
Ragati	Kibirigwi Secondary School and Kibirigwi special school - both institutions directing some of their waste to Ragati river	37 M 0297597 UTM 9941642
Ragati	Kibingo shopping centre	S 00 33.874 E 037.285
Ragati	Riakatei shopping center	37 M 0279386 UTM 9914640
Ragati	Kibingoti town	37 M0298335 UTM 9937704
Ragati	Sewerage for Karatina town	37 M 0293383 UTM 9946942
Ruji weru	Njuone shopping centre	N 00 15.747 E 037 57.152
Ruji weru	Kiengu shopping center - a lot of rubbish in the river just near the bridge, most of the pollution from the nearby shopping center	37 N 0385964 UTM 0029452
Ruji weru	Huge drainage furrow - carries a lot of water and rubbish downs into the river during rainy season	37 N 0386357 UTM 002910
Rwamuthambi	Kagumo town:	37 M 0303598 UTM 9947259
Saba Saba River	Kagumo Center	0.853310^{0}S 37.105640^{0}E
Thangatha	Irindori shopping Centre	N 00 09.343 E 037 52.600
Thangatha	Kivuithu shopping centre	N 00 07.456 E 037 53.999
Thangatha	Kiolo shopping center	37 N 0375141 UTM 0018854
Thangatha	Kilindo shopping center	37 N 0374713 UTM 0020763
Thiba	Gategi shopping centre	S 00 26.173 E 037 27.519
Thiba	Makindu shopping center	37 M 0329704 UTM 9918415
Thiba	Pollution spot	37 M 0331026 UTM 9919166
Ura	Kirindini shopping centre	N 00 21.378 E 037 92.778
Ura	Maua town	N 00 21.847 E 037 92.848

Factories: Tea and coffee factories, and especially the latter, were identified as key pollution hotspots in the catchment. Coffee factories use a lot of water in their processing, and all this ends up back in the river. Most coffee factories, due to their water needs, are also located near water bodies. Tea factories, though less polluting, especially because their main effluent is from factory washing, also contribute to pollution as they have small effluent ponds which fill up and drain into the river during the rainy seasons. Tea factories also degrade the catchment through the use of firewood for their boilers. Due to insufficient wood supply, farmers sometimes even cut fruit trees and Euphorbia trees as was the case in lower Thiba basin.

Table 3.36: Factories in UTaNMRP

River Basin	Factories	GPS coordinates
Kiiye	Kibugu Farmers Cooperative Gikumbo Coffee factory	37 M 0325374 UTM 9950435
Kiiye	Kiiye coffee factory	37 M 0324870 UTM 9950352
Kinyaritha	Kiruai Coffee Factory	37 N 0352021 UTM 0009484
Maara	Weru tea factory	S 00 16.133 E 037 38.241
Maara	Weru coffee factory	S 00 15.975 E 037 38.052
Maragua	Githambo tea factory	– 0.72822 36.89242
Mariara	Mariene coffee factory	S 00 01.693 E 037 64.212
Mariara	Ruaruaro coffee factory	37 M 0354395 UTM 9995700
Mariara	Maura coffee factory	37 M 0352440 UTM 9995404
Mathioya	Kirurumo coffee factory	37 M 0276198 UTM 9932843
Murubara	Coffee factory at Kianyaga	S 00 29.748 E 037 21.463
Murubara	Coffee factory at Kariru	S 00 28.499 E 037 21.668
Ngaciuma	Kithoka coffee factory	-0.09731 37.66994
Nithi	Kajiara coffee factory, - next to a small wetland and two fish ponds:	37 M 0349788 UTM 9969791
Nyamindi	Muburi coffee factory	37 M 0320393 UTM 9948458
Nyamindi -	Kamwangi coffee factory - a small encroached wetland near the factory	37 M 03216337 UTM 9958408
Ragati	Coffee factory at Ihwagi	S 00 26.925

River Basin	Factories	GPS coordinates
		E 037 08.075
Ragati	Kibingoti Coffee factory	S 00 34.802 E 037 11.317
Ragati	Ragati tea factory	37 M 0295075 UTM 99567831
Ragati	Ragati coffee factory	37 M 0297964 UTM 9941223
Ragati	Kangocho coffee pilling station	37 M 0295569 UTM 9943678
Ruji weru	Ntwene coffee factory	N 00 15.872 E 037 57.098
Rupingazi	Kithungururu coffee factory	S 00 29.059 E 037 26.910
Rupingazi	Gathoeri	S 00 28.794 E 037 27.142
Rupingazi	Central Ngandori coffee factory	S 00 25.914 E 037 27.559
Rwamuthambi	Riakiaria coffee factory,	37 M 0301251 UTM 9947259
Rwamuthambi	Kariani coffee factory	37 M 0301329 UTM 9943976
Thangatha	Githu coffee factory	N 00 07.454 E o37 53.855
Ura – cited for Air pollution	Kiegoie tea factory	N 00 21.847 E 037 92.327

Washing in the river: This was a common practice across all river basins and consisted of bathing, washing of clothes, car washing, and more recent and more prevalent, the washing of motor bikes. This activity results in polluting rivers through use of soaps which increase phosphate concentrations in river leading to eutrophication. Other elements like oils and other pollutants from vehicles also end up in the river. Other than washing, oxen and donkeys used for fetching water are also taken right inside the river. The same applies for livestock watering.

Plate 3.21: Motorbike washing on Maragua river

Plate 3.22: Clothes washing by a child on Murubara river

Plate 3.23: Persons bathing on Ragati river

Plate 3.24: Cattle truck fetching water on Thiba river

Table 3.37: Washing Hot Spots in UTaNMRP Basin

River Basin	Hot spots	GPS coordinates
Kiiye	Washing area, including motorbikes – includes bathing	37 M 0325187 UTM 9950406
Kinyaritha	Washing and watering point near bridge	37 N 0354470 UTM 0010164
Maragua	Human bathing	37 M 0282161 UTM 9914434
Murubara	Clothes washing and bathing/swimming near Kutus town - A lot of garbage from Kutus town, the bridge is near and there are shrubs with human waste	37 M 0313378 UTM 9936939
Murubara	Clothes washing near Murubara bridge - small scale rice farming in the area	37 M 0318432 UTM 9926697
Murubara	washing and livestock watering area	37 M 0318684 UTM 9925731
Murubara	Bathing and washing	-0.70635 37.43062
Ruji weru	Kaithe - washing clothes	37 N 0384710 UTM 0029086
Ruji weru	Washing and watering	37 N 0385250 UTM 0029017
Ruji weru	Washing and animal watering	37 N 0385094 UTM 0028753
Thangatha	Washing point near Kawamwitho bridge - washing of all kinds, clothes, motorbikes	37 N 0375169 UTM 0019313

Unfriendly trees: Planting of Eucalyptus trees in the riparian areas is also major environmental concern among Water Resources Users Association (WRUAs). This was common along most rivers though some WRUAs like Ragati had started pegging riparian areas and planting indigenous trees.

Households as pollution sources: Poor sanitation, especially in the lower catchments, where sanitary facilities are lacking is also a key environmental concern, leading to pollution of both surface and ground water. Improper disposal of solid wastes at the household level also leads to general pollution of the surrounding, with some of these wastes finding themselves in water bodies.

3.3.4Road Embankments

On the whole, only the major roads (Class A, B, C) have proper drains incorporated in their design. These only make up a small percentage of the roads in the upper tana as seen in table 3.38 below.

Table 3.38: Road Classification in Upper Tana Counties

County	Muranga	Nyeri	Embu	Kirinyaga	Meru	Tharaka Nithi
Total Roads (Kms)	2,934.9	3,092.73	914.3	1,109.11	1,259.9	1,670
Bitumen surface	387.5	450	120	106.5	225.7	61
Gravel surface	1,313.1	1,390.59	548	462.05	266.7	36.4
Earth surface	1,234.3	1252.14	346	540.5	767.5	1,040

The gravel and earth roads do not have adequate diversion channels for runoff and are thus prone to erosion mainly because of lack of retention structures off the roads, leading to deep gullies. In the upper tana catchment, key areas of soil erosion from roads were areas with steep road embankments, new roads, and areas where there are burst pipes. Sections of roads near culverts, cattle tracks, and foot paths are also prone to erosion. On the whole, approximately 50 Km of these roads will require rehabilitation.

Key roads identified were:

i. Murang'a – Kangema road vide Michuki technical especially around Kiamara area where there are collapsing ridges on roads (-0.69717/37.06499); opposite Michuki technical; around Nyakahura town; and between Kanorero primary and Kangema High: total about 6 Kms (-0.7076 37.1173; -0.7057 37.1129; -0.7324 37.1001; -0.7179 37.1248; -0.6995 37.1169)
ii. Between Murang'a and Kangema vide Mugoiri; about 3 Kms (-0.6914 37.1058)
iii. Muranga – Mukurweini road (-0.6584 37.1199)
iv. Off Muranga- Kireini road (-0.7125 37.0609)
v. Sagana – Mukurweini road – about 3 Kms(-0.6723 37.1934; -0.6606 37.1680)
vi. Around Kiangai town – about 5 kms (-0.4800 37.1785)
vii. Kathigu in Egoji area 3 km: area with stones quarrying for ballast on road embankments (-0.5814 37.6729)
viii. Ndagaini – Mitheru-Nithi Bridge-Marima – 10 kms(-0.2569 37.6428)
ix. Kariani area – Meru: about 3 km (-0.0833 37.6211)

3.3.5Hilltops

Hilltops are "forested" ecosystems surrounded by farming and grazing lands. Hilltops offer environmental services including water catchments and amelioration of the climate. In upper tana catchment, hilltops are used as dry season grazing areas for most local communities and most are owned by the county governments. They are however not protected and suffer environmental degradation due to the phenomenon of the 'tragedy of the common' as people exploit them unsustainably. Charcoal is also produced from trees especially in the dry seasons, leaving most of the hill tops bare.

The problem of tenure (over 60% of hilltops not gazetted) are has made rehabilitation of hilltops difficult as tree seedlings planted are not protected and usually destroyed by livestock grazing and other human activities. Efforts to gazette some of them and form CFAs have also been made.

Gazetted hill tops include:

i. Kiambicho (which has 3 smaller hills of Kangure, Karua and Kiamuti) in Murang'a county which also has a CFA
ii. Maranga hill (220ha) in Embu County (degraded area of about 50ha)
iii. Ntugi/Kamerete in Meru County which also has a CFA
iv. Mweru –Biaminkure in Meru County which also has a CFA

Other hilltops in the area include:

i. Ithanga hill in Murang'a County –(about 50 ha degraded)
ii. Gaturi, Kiharu, and Kabuta area hills in Murang'a county – 50 ha
iii. Kiagu hill (932 ha) in Meru county - mainly bushland
iv. Nyeri hill in Nyeri county
v. Karima Kaathi Hill, Meru county:- hill has Njuri Njeke shrine; it has scattered bushes shrubs and indigenous trees; Some parts of the hill are highly eroded
vi. Ngirimi Hill, Meru county: has a few remaining indigenous trees; is also planted with exotic trees especially eucalyptus; clearing of land is ongoing to pave way for farming
vii. Grumpu Hill, Meru county: has very scattered shrubs, bushes and indigenous trees
viii. Kiambori Hill, Meru county: highly degraded
ix. Tudui, Meru county: highly degraded
x. Matatu, Meru county: highly degraded
xi. Njotamu, Meru county: highly degraded
xii. Mukundu Hill, Meru county: highly degraded, human encroachment
xiii. Kagichu Hill, Meru county: highly degraded, human encroachment

xiv. Kiathindi, Meru county: Human encroachment, highly degraded with a lot of soil erosion with few indigenous trees
xv. Kilimene Hill, Meru county: Human encroachment, highly degraded with a lot of soil erosion with few indigenous trees
xvi. Rubune Hilltops, Meru county: Lot of land slide , few trees remaining and human encroachment
xvii. Kibiraku Hilltops, Meru county: Lot of land slide , few trees remaining and human encroachment
xviii. Kitheti Hilltops, Meru county: Lot of land slide , few trees remaining and human encroachment
xix. Athiachi Hilltops, Meru county: Lot of land slide , few trees remaining and human encroachment
xx. Muthangutha Hilltops: Lot of land slide , few trees remaining and human encroachment
xxi. Kithanga Hilltops, Meu county: Lot of land slide , few trees remaining and human encroachment
xxii. Kuani Hilltops, Meru county: Lot of land slide, few trees remaining and human encroachment
xxiii. Rukununu Hilltops, Meru county: Lot of land slide, few trees remaining and human encroachment
xxiv. Chura Hilltops, Meru county: Lot of land slide, few trees remaining and human encroachment
xxv. Kathinge Hilltops, Meru county: Lot of land slide, few trees remaining and human encroachment
xxvi. Karima Mpuria, Meru county: Lot of land slide, few trees remaining and human encroachment
xxvii. Nandora Hill, Meru county: Lot of land slide, few trees remaining and human encroachment
xxviii. Njogune Hill, Meru county: Lot of land slide, few trees remaining and human encroachment
xxix. Kirimiri hill in Embu county(101ha) managed by the KFS though it is on trustland
xxx. Kianjiru hill in Embu county(1004ha) managed by the KFS though it is on trustland
xxxi. Kiangombe hill in Embu county(2104ha) managed by the KFS though it is on trustland
xxxii. Kiambere hill in Embu county(643 ha) managed by the KFS though it is on trustland
xxxiii. Ndune hill in Embu county(1004.2 ha) managed by the KFS though it is on trustland

3.3.6 Forest Areas

There are several forests within the upper Tana catchment, with the main forests being the Mt. Kenya, Aberdares, and Nyambene Hills.

The Mt. Kenya part of the catchment covers 213,000 ha. The forest reserve (including the 5 blocks of Lower Imenti, Upper Imenti, Thunguru, Njukiini west and east and Kierera) are administered under 21 forest stations spread throughout the forest reserve. The forest stations are administered by five Ecosystem conservators based in Nyeri, Kirinyaga, Embu, Tharaka Nithi and Meru Counties.

The upper tana catchment section of the Aberdare forest consists of 80,000 haand is administered under 6 forest stations and two Ecosystem conservators in Murang'a and Nyeri Counties.From the survey, degraded areas per forest station identified include those shown in table 3.39 below.

Table 3.39: Degraded Forest Areas in UTaNRMP Basin

ECOSYSTEM	COUNTY	No.	FOREST STATION	Area	Approx. Area Requiring Rehabilitation**	Preferred species for rehabilitation
Mt Kenya	**Embu**	1.	Njukiini East	445	80	Prunus Africana;
		2.	Irangi	18,393	500	Ficus sycomorus;
		3.	Maranga Hill			Markhamia hilderbradtii;
		4.	Kiangombe Hill			Vitex keniensis; Zizygium guinensis
	Tharaka Nithi	5.	Chuka	23,403	1,000	Prunus africana; Prodocarpus spp
		6.	Chogoria	16,000	nil	Murindi (Muringiti)
		7.	Kiera Hill	931	nil	Celtis africana Olea (Mucharage) Bridelia Micrantha Vitex Keniensis Erytia symosa Croton megalocarpus Zizygium guinensis Fagara microphulus Markhamia Lutea
	Meru	8.	Ruthumbi	12,605	200	*Celtis Africana (*Murundu *);*
		9.	Meru	5,946	10	*Olea Africana*
		10.	Lower Imenti	2,462	500	*(*Muteero/Muuru) ; *Croton*
		11.	Mucheene	10,200	150	*megalocarpus(*Mukinduri*);*
		12.	Marania	7,280	10	*Croton macrostachys*
		13.	Ontulili	32,927	1,500	*(*Mutuntu *); Syzigium*
		14.	Ngare Ndare	5554	nil	*guinesea (*Mukoe/Mokoigo*'*
		15.	Nyambene Hills	8000	2000	*Makhamia lutea*
		16.	Ngaya	500	30	*(*Mugwani*); Ficus sycomorus (*Muguku *); Cordia abyssinica (*Muringa*); Mellitus dura (*Mururi *);* Bamboo

ECOSYSTEM	COUNTY	No.	FOREST STATION	Area	Approx. Area Requiring Rehabilitation**	Preferred species for rehabilitation
						(Murangi); Podo spp; Newtonia abysinica;
	Nyeri	17.	Nanyuki	9,855	10	Croton megalocarpus; Macaranga spp; Canopharagia holstii; Olea hochstetteri; Albizia gummifera; Croton macrostachyus; Cordia abysinica; Teclea nobilis; Podocarpus glacilior; Ocotea usambarensis; Bamboo spp; Podocarpus glacilior; Polyscias kikuyensis Albizia gummifera
		18.	Gathiuru	14,985	20	
		19.	Narumoru	7,195	20	
		20.	Kabaru	13,395	60	
		21.	Hombe	3,618	20	
		22.	Ragati	10,478	30	
		23.	Chehe		10	
	Kirinyaga	24.	Kangaita	4,598	88	Podo spp; Rauvoltia caffra (Mwerere); Vitex keniensis; Fagoropsis angolensis (Mukaragati); Ekebergia capensis (Mununga); Albizia gummifera; Zizygium guinensis
		25.	Castle	19,970	500	
		26.	Kathandeini	9327	70	
		27.	Njukiini West	557	30	
		28.	Murinduko hill	194	10	
Aberdares	**Nyeri**	29.	Kiandongoro	6,860	nil	Croton megalocarpus; Macaranga spp; Canopharagia holstii; Olea hochstetteri; Albizia gummifera; Croton macrostachyus; Cordia abysinica; Teclea nobilis; Podocarpus glacilior; Ocotea usambarensis; Bamboo spp; Podocarpus glacilior; Polyscias kikuyensis Albizia gummifera
		30.	Kabage	6,340	60	
		31.	Muringato	11,693		
		32.	Zaina	10,754		
		33.	Zuti	7,838	80	
	Murang'a	34.	Kimakia	7,591.1	50	Croton megalocarpus; Macaranga spp; Canopharagia holstii; Olea hochstetteri; Albizia gummifera; Croton macrostachyus; Cordia abysinica; Teclea nobilis; Podocarpus glacilior; Ocotea usambarensis; Bamboo spp; Podocarpus glacilior; Polyscias kikuyensis Albizia gummifera
		35.	Gatare	10,548	50	
		36.	Karua	210	50	
		37.	Wanjerere	10,348.5	200	
		38.	Kiambicho	746.7	200	
	Nyandarua	39.	South Kinangop	7,359		

**Includes plantation areas reverting back to indigenous

Other than forests, there is also a lot of agroforestry ongoing in the farms. Some counties like Muranga list 270,879 acres under farm forestry in 204,557 farms (Muranga county CIDP), while Nyeri boasts of over 45,000 farmers engaged in agro-forestry, with each farm having an average 50 trees (Nyeri CIDP). This compares with Tharaka Nithi which boasts of 80 trees per farm (Tharaka Nithi CIDP). Seedlings for tree planting are also produced locally.

Generally, farmers plant nitrogen fixing and fodder species such as Acacias, *Albizzia spp*, *Lencena spp*, *Sesbaniaspp* and *Calliandraspp* to improve soil fertility through fixing nitrogen in the soil. Other trees grown are fruit trees and medicinal plants, while some farmers plant trees like eucalyptus and Grevillea for commercial purposes.

3.3.7 Human-Wildlife Conflicts

The findings from the survey indicate that approximately 35% of households experienced human wildlife conflicts. The rivers basins with the most conflicts were Rupingazi and Amboni at 83% each; and Nairobi (80%), while Rwamuthambi and Mariara registered none. It was noted that places where solar fences were recently put did not register complaints as they were still enjoying the reprieve from past human/wildlife experiences.

The main type of conflict is invasion of farms by wild animals, which results in crop destruction, though there were sometimes human injuries and even deaths on one hand, and wildlife also being killed. The main problem animals are:

- Elephants
- Crocodiles
- Baboons and monkeys
- Hippos
- Snakes

Most communities cope by chasing the animals away using drum and fire or by calling the Kenya Wildlife Service. In some cases, communities actually kill problem animals while some had moats. Others use psychological fences and pepper fences to deter problem animals.

There was no compensation for crop damage or human injuries in the past while deaths were compensated with very little money. The new wildlife Act has addressed this issues and compensation is now well addressed.The human wildlife conflicts experienced in the UTaNRMP is summarized in the table below

Table 3.40: Human Wildlife Conflicts in the UTANRMP Basin

River Basin	Area prone by conflict	Problem animals	Coping mechanism
Nairobi	Ngonde forest, Mathina	elephants and monkeys	scare them, contact KWS
Sabasaba	Saba saba River	crocodile attacks	Scare them
Amboni	Kiganjo, Kibiruini forest	elephants, monkeys, leopards	scare them, contact KWS
Ura	Near national park	Elephants	scare them
Nyamindi	Nyamindi River	Primates	scare them
Thika	Near the river	monkeys, porcupines, antelopes	scare them, use traps
Maragua	In farm areas	Monkeys	scare them
Thangatha	In farm areas	Monkeys	scare/trap them
Thiba	In farm areas	hippos, monkeys, baboons	scare them, trap them
Mathioya	In farm areas	monkeys, moles, porcupine	trap/scare them
Ena tributaries	In farm areas	monkeys, squirrels, birds	scare them away
Maara	along river Maara	Monkeys	chase them away, scare them
Thingithu	In farm areas	eagles, monkeys, baboons	scare them away
Murubara	In farm areas	monkeys, baboons	scare them away
Ragati	Near forest	monkeys, elephants	call game rangers, scare them away
Rupingazi	Mt. Kenya forest	elephants, monkeys, leopards	scare them, contact KWS
Bwathunaro	Near national park	Elephants, monkeys, Baboons	scare them, call KWS
Thuci	along Thuci River	Monkeys	scare them
Thanantu	Nduruku	elephants, monkeys, leopards	scare them, contact KWS
Muringato	Njengu	antelopes, elephants, monkeys, leopards	scare them, contact KWS
Kathita tributaries	near the river	elephants, monkeys, Hyenas	scare them, contact KWS
Kayahwe	In farm area	monkeys, Baboons	trap/scare them
Iraru	In farm area	monkeys, baboons	scare them away

3.3.8Household Energy Usage and Use of Energy Efficeint Technologies

The main source of energy for cooking was done with firewood – 85% with some households also using charcoal - 8%. Where firewood was used, it supplemented firewood use, or in peri-urban centres, and as such firewood can be said to be used by nearly all rural households.

These figures agree with those of the county integrated development plans. The figures, though lower can be explain because they cover the whole county including larger urban centres which were not covered within the river basins.

Table 3.41: Cooking and Lighting Fuels uses in Households

County	Muranga	Nyeri	Embu	Kirinyaga	Meru	Tharaka Nithi
Cooking fuel						
firewood	66	72.5	Not determined	69	86.1	90
charcoal	14.6	4.3		38	6.6	14.9
kerosene	12.4				4.5	
Electricity	0.4					0.9
LPG	6	1.5		18		3.8
Biogas		Not determined				0.1
Lighting fuel						
Electricity	11.5%	26.3	Not determined	8	13.6	
Solar	1.6%				6.6	
kerosene	86	83.9			80	68.7
Biogas					0.1	

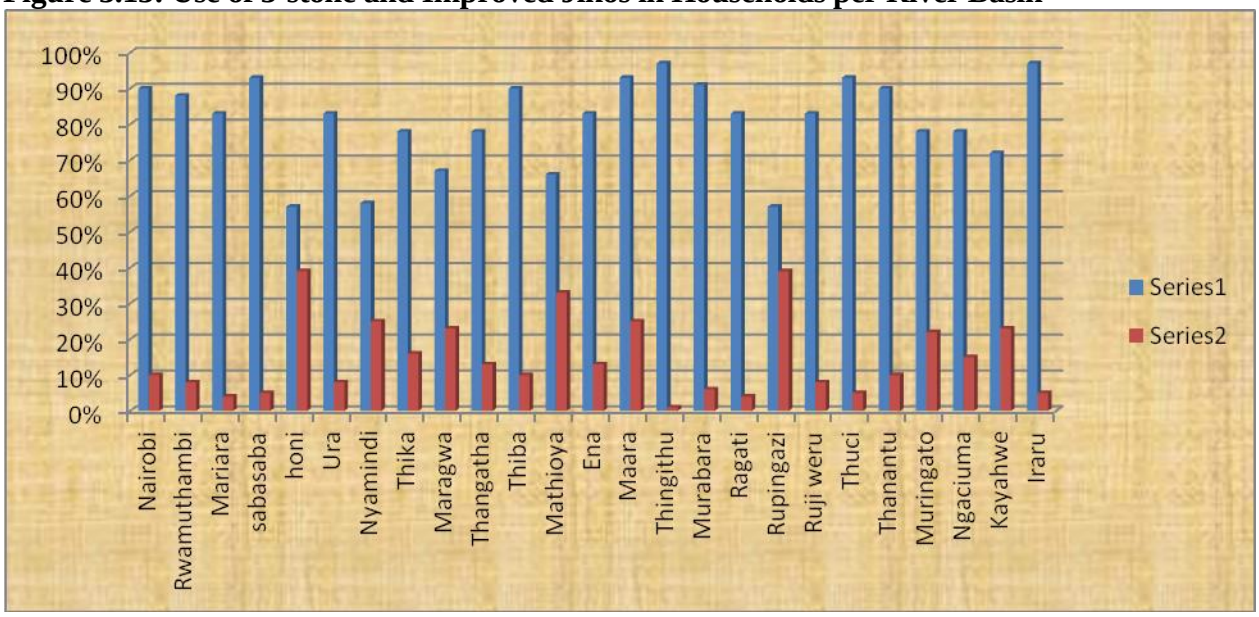
Source: County Integrated Development Plans

Most households sourced their firewood on-farm (70%), while 11% sourced firewood from forests and an even higher percentage purchased firewood or collected from the general community areas (16% for both).

Forest firewood collection was mainly for the forest adjacent communities in the higher catchments, with Muringato and Nairobi having the highest percentage of forest firewood collectors (56% and 40% respectively) while Ruji weru, Thika, Thiba, Maara and Ngaciuma had below 5%. Collection usually took an average 40 minutes a day and was within 1.5 Kms

The survey indicates that 83% of households use the three stone jiko, while 13% used improved cook stoves. Most households (70%) did not know the actual names of the jikos but observations revealed they used either liners or *upesi jikos*. A few households (1%) also had fireless jikos and most of these households were members of either a CFA or CIGs dealing with improved cook stoves.

Figure 3.13: Use of 3-stone and Improved Jikos in Households per River Basin



Source: Field data

These figures also agree with those of county integrated development plans where Muranga has lease use of 3-stone jikos at 70%, followed by Nyeri at 82%. Murang'a county has the highest use of improved firewood and charcoal stoves due to availability of local materials for making liners. There is also commercial production of cook stoves at Gitoro off the Murang'a – Mugoiri road. Nyeri also has a high percentage due to efforts made by the Ministry of Energy Centre at Wambugu farm.

To promote uptake of energy saving devices, the project has to overcome challenges noted in past studies, namely:

i. Lack of general awareness on the energy saving devices;
ii. Lack of belief that the jikos actually save on wood until they actually experience it themselves;
iii. Availability of energy saving jikos – firewood-using stoves are not as common as those which use charcoal in local markets;
iv. Quality concerns as some traders are known to make the liners using cement rather than clay, and then painting the liners red. Such stoves are known to easily crack and have a very short lifespan, discouraging the users.

v. Lack of initial capital to acquire the technologies

It is thus important to create awareness among communities about the devices, demonstrate that they actually save on firewood, and promote a viable market chain for the energy efficient technologies that incorporate quality assurance. For financing, it is important that communities are linked to financiers to access the technologies.

3.3.9Charcoal Production

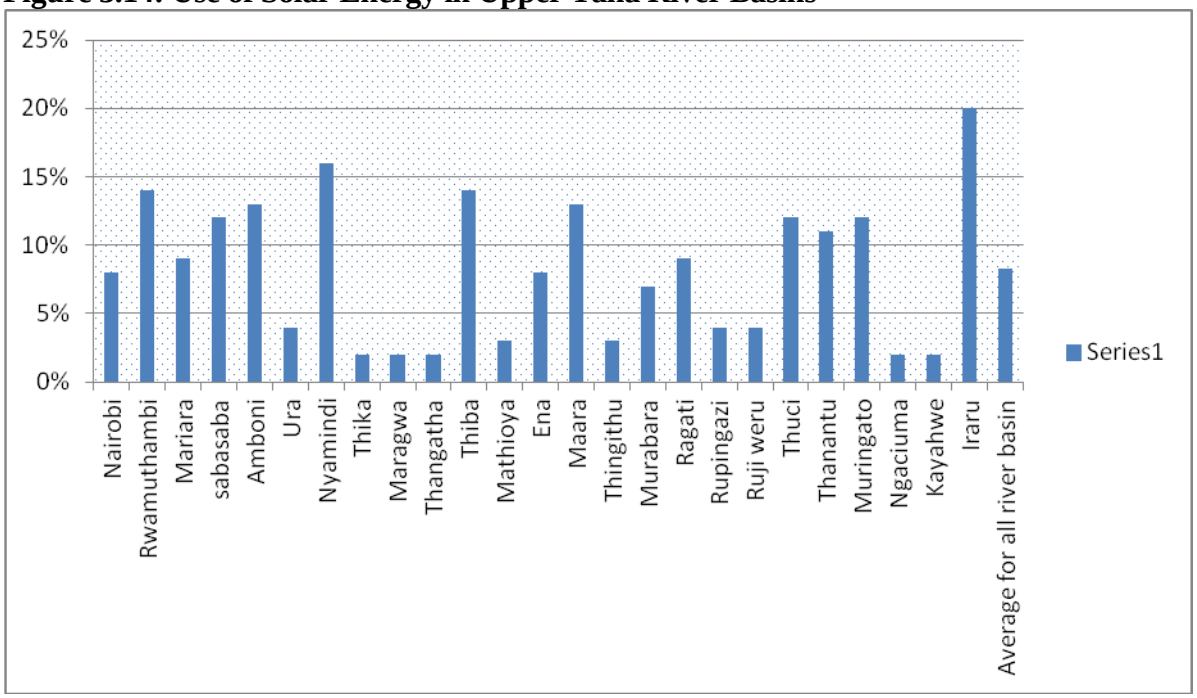
Charcoal was usually (87%) purchased from local markets, with some households making their own (24%) at times. Other than those who sometimes made charcoal or sourced locally from other farmers, most households (70%) did not know the source of their charcoal. All charcoal used was however said to be made using traditional earthen kilns other than that produced at Kakuzi Ltd where efficient charcoal (half orange brick kilns) producing kilns are used.

There were only two registered groups of charcoal producers registered with the Kenya Forest Service in all the Ecosystem conservators' offices in the UTaNRMP area. There are however efforts to register more, including suppliers as a first step.

3.3.10Green Energy

Lighting was predominantly through use of kerosene with the whole catchment registering 68% usage, followed by electricity at 21%. Electricity connections were high near small urban centres, but were also higher in the upper zones which had 21%, nearly double that of the lower zones at 13%, while the middle zones had 18%. Use of biogas was also low at 1%. Only 10% used green energy sources, mainly solar.

Figure 3.14: Use of Solar Energy in Upper Tana River Basins



Ownership of Solar Home Systems and lanterns was 9% but ranged between 4% - 15% with Honi and Iraru rivers having a higher percentage. This was corroborated with lighting data which showed 8% uptake of solar lighting. Solar use was however higher in the lower regions at 11% compared with the middle and upper which had 8% and 7% respectively. The high use in the lower regions may be associated with better sunshine regimes.

Use of LPG: This was only about 10% in the upper tana catchment with higher uptake in river basins passing through major towns.

The main challenge of green energy uptake is lack of awareness and access to technologies. People also assume a 'wait and see' attitude to see whether the technologies work. To promote them, UTANRMP should demonstrate that they are feasible financially, technically, and environmentally/ they should also ensure that they are accessible and where possible affordable.

3.3.11Environmental Awareness

Very few persons had attended any environmental training courses, with only 12% of household members interviewed indicating they had attended such courses. Indeed, most river basins like Nairobi, Mariara, Rwamuthambi, Thiba, Saba Saba, Ragati, and Thanantu had less than 5% household members undergoing such training. Most of these were officials of WRUAs, CFAs and other CIGs. The main courses they had attended were on bee keeping, tree nursery management, and soil conservation.

The benefits accrued by households for environmental management were: Soil conservation; greening of the environment and subsequently fresh air; shade and beauty; and income from selling of seedlings and trees.

Only 36% of the HH respondents were able to identify and name an environmental hotspot, with the highest percentages (average 52%) being in Thangatha, Kayahwe and Mariara. The hotspots identified at household level were tea and coffee factories, sewerage plants in towns e.g. NYEWASCO, trading centres, farm agro-chemicals, quarries, human activities in rivers (contamination), and Mwea irrigation scheme.

The key challenge in protection of springs and wetlands were tenure, most fall on private lands. Others were lack of funds e.g. to fence off, or to start a fish keeping project. The main activity taking place around wetlands was agriculture, and some livestock watering. Communities also felt that there was need for increased sensitization on the importance of these ecosystems especially wetlands and springs.

The main environmental challenges listed across all river basins were water pollution (58%) and climate change (39%). The evidences of climate change were unpredictable and unreliable rainfall, which has led to low agricultural yields. Pollution was made manifest by diseases like typhoid and amoeba.

Efforts to mitigate adverse environmental challenges across all river basins focused on trees planting, which was also the main activity among environmental groups. Other efforts were geared towards environmental awareness creation, and irrigation, water harvesting, and agricultural diversification to adapt to climate change. The efforts were deemed to be somehow successful by about 43% of households across the river basin. However, there was need for more funding and awareness creation to help mitigate environmental damage and adapt to climate change.

More people were aware about WRUAs (52%) than CFAs (34%), the difference being that CFAs only exist in forest adjacent communities, and that there is more interest in water for most people, with less interest in the forest especially when it is far off. There was higher awareness of WRUAs where and SCMP had been undertaken (65%) compared to where none had been done (40%), while those with no existing WRUAs in the river basins had the lowest awareness (22%). There was also low awareness of environmental groups at 34%, with most river basins ranging between 20% - 50%.

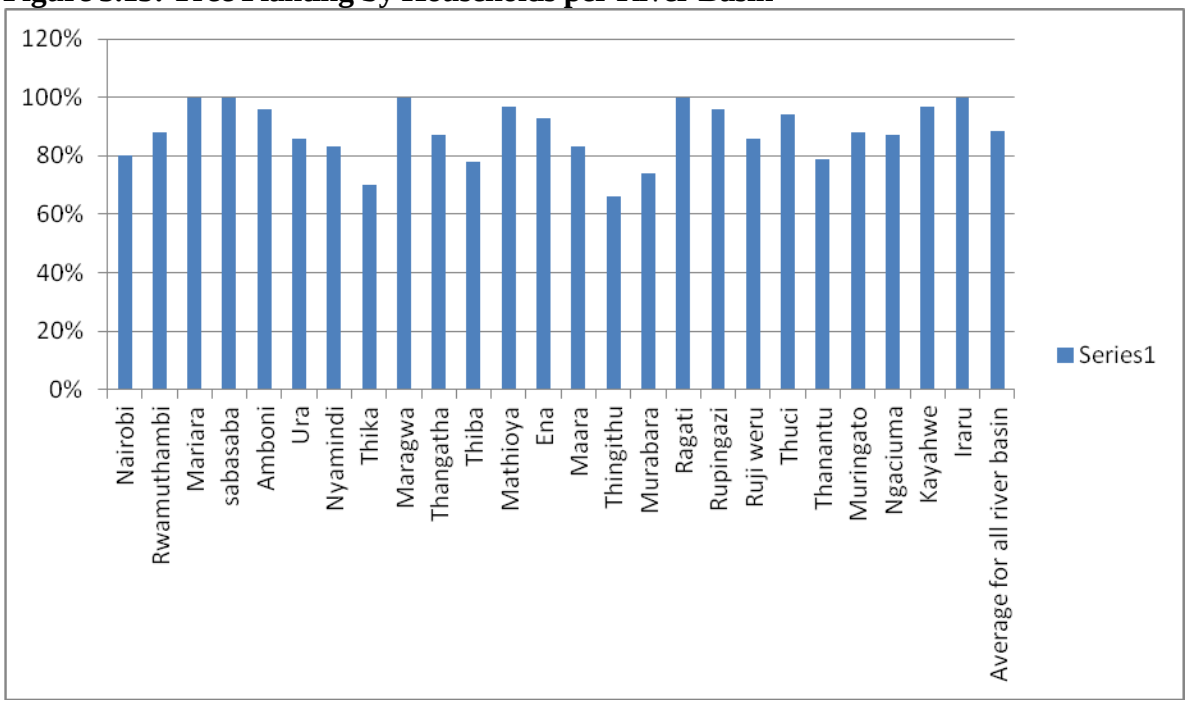
Environmental awareness can also be measured by activities being undertaken by communities e.g. water harvesting, improved irrigation, tree planting, tree nurseries among others.

i. Only 35% of the households harvest rain water, with most giving the reasons of not doing so on high costs of storage tanks.

ii. For those irrigating, only 5.5% used drip irrigation, with the others (29%) using overhead sprinklers, and 12.6% using buckets and flooding.

iii. Tree planting is undertaken by about 88% of households in the river basins, with no significant difference among the river basins. The main tree species planted is *Grevillea Robusta* with other species being Eucalyptus, and Cassia species in the lower catchments, mainly due to its ability to withstand termites. The main reasons given for tree planting are soil conservation, shade, firewood, aesthetics, timber, and for income.

Figure 3.15: Tree Planting by Households per River Basin



iv. 44% of household had also participated in tree planting in forest areas where indigenous tree seedlings had been planted for conservation purposes.

v. There were sufficient tree seedlings in the UTANRMP. In Muranga country for example, there were about 500 nurseries with about 6 million trees, with KFS having 0.5 million alone.

Environmental awareness can also be measure by undertaking of Environmental Impact Assessments (EIA) and Environmental Audits (EA) of development project. In this regard, Nyeri County leads with 950 applications received, with 350 approvals being granted for EIA,

and 300 EAssubmitted and 150 executed. Other counties that had these records in their CIDPs include Muranga with 176 EIA and 29 EA; and Tharaka Nithi with 44 EIAs and 9 EAs.

3.3.12 Recommendations for Environmental Issues

ii. 8 CFAs be assisted formulate Participatory Forest Management Plans
iii. 12 CFAs be assisted update Participatory Forest Management Plans
iv. All CFAs be assisted to implement activities planned in the PFMP
v. CFA scouts capacity built and provided with logistical support to aid protect forest areas
vi. Train CFA's in fire monitoring and fighting
vii. Assist KFS register charcoal producers and then train them in sustainable charcoal production
viii. UTaNRMP promote use of efficient charcoal production kilns
ix. UTaNRMP does capacity building of players in the improved cook stoves value chain, specifically focusing on production of quality cook stoves, linking producers with markets, and also ensuring that a sustainable ICS market is created.
x. UTANRMP also focus on solar lanterns in line with the Renewable Energy Policy and Energy Bill both of with target on eliminating kerosene as a household fuel by 2022.
xi. Green energy types – including biofuels, be promoted in the project area through community sensitization on their advantages and feasibility e.g. financial pay back, cleanliness, and environmental benefits.
xii. Wildlife barriers be constructed to reduce human wildlife conflicts
xiii. It is recommended that a revolving fund be set up for CFAs and WRUAs to assist in uptake of water harvesting on-farm.
xiv. UTaNRMP support establishment of trees nurseries both to promote tree planting and as support to livelihoods of CFA members
xv. UTaNRMP continue with the successful school greening programme initiated under MKEPP
xvi. UTaNRMP initiate environmental programmes that conserve the environment while at the same time accruing direct benefits to the community members. Such initiative include eco-tourism, bee keeping and processing, fish farming, tree nurseries, butterfly and silk farming among others.
xvii. UTaNRMP support counties and sub-counties deal with solid wastes management;
xviii. Support environmental awareness creation and sensitization for the whole Upper Tana.

3.4 RURAL LIVELIHOODS

3.4.1 Background to Agriculture Sector

Kenya's economy is dependent on agriculture, which contributes to rural employment, food production, foreign exchange earnings and rural incomes. The agricultural sector directly accounts for about 26 per cent of Kenya's Gross Domestic Product (GDP) and 27 per cent indirectly through linkages with manufacturing, distribution and other service related sectors (Kenya Economic Report 2013, GoK). The sector accounts for 65 per cent of Kenya's total exports, 18 per cent and 60 per cent of the formal and total employment, respectively. The agriculture sector has been a key driver of economic growth in Kenya for the last four decades and is the main source of livelihood for almost 80 per cent of Kenya's population living in rural areas. The key policy goals of the sector are in line with Kenya Vision 2030, and are guided by the Agriculture Sector Development Strategy (Government of Kenya, 2010) framework, which emanated from a revision of the Strategy for Revitalizing Agriculture (2003). Overall, the sector is critical in realizing the various targets that are set out in the Millennium Development Goals (MDGs), especially that of reducing hunger and poverty.

3.4.2 Main Economic Activities in the Counties

The main economic activities in the counties are dominated by agriculture, i.e. Cash and food crop farming. In the upper zones in Muranga, Nyeri, Kirinyaga, Tharaka Nithi, Embu and Meru counties cash crop grown consists of tea, whereas the middle zones is coffee. Food crop is mainly grown in the middle zone i.e. Maize, beans, and bananas. In the middle zone farmers also engage in livestock farming (zero grazing), and Aquaculture (trout and tilapia fish). The lower zones are characterized by livestock (free range) fruit tree farming (especially mangoes), cereals, and Apiary (see Table 3.42).

3.4.3 Main Land Use Pattern

The main land use pattern in all the counties is agriculture, which ranges from cash crop, food crop, fisheries, horticulture, and commercial banana production in the upper and middle zones. The lower zones are dominated by livestock production, where the land is available for free range grazing. The area provided in this section includes, water mass, and gazette forests, as well as administrative area.

Muranga County occupies approximately 2,558.9$Km^{2,}$ of which 11.2Km^2 is water mass. The arable land is, 2,135 Km^2 while non-arable land is 163.3 Km^2. The main land use activities in the county are: cash crop farming, subsistence farming, livestock keeping, fish farming, housing and

forestry. The average acreage is 1.4 acres, in the upper zones and 16 acres in the lower zones. Food crop occupies 329,254 acres, cash crop 177,636 acres,and farm forestry 270,879 acres. Organic farming covers 385,364.5 acres which is done using manure(Muranga County CIDP 2013).

Kirinyaga County occupies 1,478.1 Km^2 with arable land occupying 116,980 Ha (79%), food crop 50,864 Ha, and Cash Crop 31,244 Ha. The average farm size for large scale farms is 5.2 Ha, and 1 Ha for small scale farms. The average land holding of 0.0958 ha per HH in the upper zones (CIDP Kirinyaga County 2013), where as in the lower zones the National Irrigation Board (NIB) owns 30,350 acres, out of which 16,000 acres has been developed for rice farming) production, whereas the rest is used for settlement, public utilities, subsistence and horticulture crops farming(www.nib.go.ke) In the lower zone also lies Ngariama Ranch which has been converted into a settlement scheme.

The main crops produced include bananas, tomatoes, beans, mangoes, and maize and horticulture crops. Rice farming occupies 16,000 acres in NIB zones, and 4000 acres for out growers. Study findings indicate that out growers' undertaken rice farming on wetlands especially in Kirinyaga County.

Nyeri County occupies 3337. Km^2 which is divided as follows: Gazetted forests 987.5 Km^2, Arable land 758.5 Km^2, Water mass 115.15 Km^2, Non-arable land 49 Km^2, and urban areas 6 Km^2. Gazetted forest occupies 987.5 Km^2 and 758.5 Km^2 of arable and non-arable land respectively. The larger part of the land is used for food crop while the rest is used for cash crop farming, livestock rearing and farm forestry. The mean holding size is 0.7 ha for small-scale farmers and 4 Ha, for large scale farmers. The total area under food crop is 80,943 Ha, while 18,521 are under cash crop. The main cash crops grown include coffee, tea in the upper zones, horticulture and cut flowers in Kieni Sub County. Food crops include maize, beans, bananas, Irish potatoes, and vegetables.

Tharaka Nithi County occupies 2,662.1 Km Km^2 including the shared Mt Kenya forest estimated to be 360Km^2. The main land use pattern in the county is agriculture i.e. food crop and livestock production. Food crops occupy 43,799 Ha, whereas cash crops cover 14,839 Ha. The mean land holding is 4.8 Ha, whereas average land used for cash crop and food crop is 2.9 Ha, whereas average holding for large scale farmers is 6.7 Ha.The main food crops include; maize, beans, cowpeas, sorghum, green grams, millet, black beans. The cash crops include tea and coffee grown mainly in the upper zones of Maara and Chuka/Igambang'ombe constituencies. In the lower zones i.e. Tharaka, farmers engage in cereals and legumes production which is mainly sorghum, millet, and green grams.

Embu County occupies approximately 3,670.89km^2, of which arable land constitutes 59.6%, non-arable land 17.81%, Water mass 16.2%, Gazetted forests 4.96% and urban area 1.93%. The total acreage under food crops is about 63,760Ha while the total acreage under cash crops of 18,869 Ha. The main land use activity is cash crop farming (Tea, coffee, and macadamia), food crop (maize, beans, bananas, rice, millet, green grams, sweet potatoes, cassava and Irish potatoes), horticulture farming, fisheries, and housing. The average farm size is 0.8 Ha.

Meru County occupies approximately 6,936 km². The total hectarage under food and cash crops is 161,907.2 ha and 15,773.4 ha respectively. The major land use in the county is mainly agricultural activities for both crops farming and livestock – keeping. The major cash crops are tea, coffee, miraa (khat) and bananas. Large scale farming is undertaken in Timau and Buuri constituencies, which is mainly wheat and horticulture farming. Livestock farming is also being practiced in group ranches in Tigania and Igembe. The average land holding size per household is 1.8 ha for the small scale and 18.25ha for the large scale land owners. The area with potential for irrigation is 81,262 ha with only 2,131 ha under irrigation.

3.4.4 Main Economic Activities and Land use Patterns in the River Basins

Agriculture is a main economic activity in the 24 River Basins and their tributaries. Both farming and livestock keeping are preferred agricultural practices in all River Basins with variations both in the level and manner of practice. On the whole, farms are generally divided for food crops, cash crops, livestock, trees, and farrow as per the percentages in the table below. The few areas left farrow are usually near water bodies, or in patches of land known to be unproductive.

Table 3.42: Land-use Distribution per River Basin

	FOOD CROPS	CASH CROPS	LIVESTOCK	FALLOW (UN-CROPPED LAND)	TREES
Nairobi	34%	25%	32%	0%	9.40%
Rwamuthambi	37%	30%	15%	1%	16%
Mariara	48%	22%	24%	0%	6%
Sabasaba	40%	26%	17%	3%	13%
Amboni	32%	3%	30%	19%	16%
Ura	26%	37%	22%	0%	16%
Nyamindi	46%	36%	6%	0%	12%
Thika	40%	14%	37%	0%	7%
Maragwa	51%	28%	14%	3%	5%
Thangatha	78%	56%	43%	0%	5%
Thiba	56%	35%	5%	0%	2%
Mathioya	62%	55%	4%	0%	7%
Ena tributaries	56%	16%	6%	0%	7%

	FOOD CROPS	CASH CROPS	LIVESTOCK	FALLOW (UN-CROPPED LAND)	TREES
Maara	45%	25%	5%	0%	12%
Thingithu	54%	36%	23%	0%	3%
Murubara	73%	53%	6%	0%	15%
Ragati	56%	22%	12%	0%	8%
Rupingazi	32%	3%	30%	0%	5%
Ruji weru	40%	34%	11%	0%	13%
Thuci	46%	28%	8%	3%	13%
Thanantu	45%	14%	4%	0%	9%
Muringato	34%	30%	15%	0%	5%
Kathita tributaries	45%	23%	7%	4%	7%
Kayahwe	65%	59%	4%	5%	8%
Ruguti	56%	34%	23%	0%	3%
Chania	34%	26%	32%	0%	10%

A part from the traditional agricultural practices, it is indicative that various new technologies like aquaculture, apiculture, and horticulture are practiced at different levels within the River Basins. The economic activities vary from the upper zones (high ecological zone) to the middle and lower zones. For instance, the types of crops grown within Sagana, Nyamindi, Rupingazi, Thiba, Rwamuthambi and Ragati River Basins are greatly influenced by various ecological zones (Kirinyaga County Integrated Development Plan (2013-2017). This pattern is characteristic of all River Basins. In the upper zones the practice is mainly cash crop farming majorly tea, and the middle zones are characterized by coffee, maize, beans, bananas, vegetables and horticultural crops. The lower zone is mainly characterized by cotton farming, maize and beans. Livestock rearing in the upper zones is mainly dairy under zero grazing for milk production. The trend is similar in the middle zones where the land acreage is averagely 4 acres per House Hold (HH). In the lower zones most farmers practice free range grazing and the livestock are mainly reared for meat production.

3.4.5 Soil Distribution and Soil Fertility in the counties and River Basins

The household survey indicated that soils are of between moderate and moderately high fertility as indicated in table 3.44 below.

Soil type distribution within the project area range from dark grayish brown (very friable, acidic humic to peat and loam) in Meru County as seen in table 3.43. In Muranga county, the soils vary from basement rocks in the upper zones, to volcanic foothill ridges in the central part, and humic topsoil of moderately high fertility in the lower altitude. In Nyeri County, the bedrock consists of volcanic rocks. On the highest parts of the mountains, soils of moderate to high fertility occur but

it is too cold for any land use. At a slightly lower altitude, soils with humic topsoil and a moderately high fertility are found and may be shallow or leached. In Kerugoya County, the soils range from volcanic to mountain soils which occur in broad zones from west to east, ranging from medium to heavy texture in the upper and lower parts. In Embu County, mountain soils occur in broad zones from West to East changing from a medium texture in the highest parts, over a medium to heavy texture in the middle, to a heavy texture in the lower parts. Soils in the Southern part of the district occur in varied patches and show mainly a heavy texture. The soils occur in broad zones which run Southwest – Northeast and they are mainly heavy in the upper middle parts, mainly medium to heavy in the lower middle parts, and light to heavy in the lower parts (Source: Muya et al., 2009)

Soil pH in Muranga County ranges from pH 3.9 in Kangema, to 6.9 in Gatanga. In Nyeri, the pH ranges from 4.4 in Mathira to 8.1 in Kieni West, whereas in Kirinyaga it is 4.1-7.14. In Tharaka Nithi the pH varies from 5.6-8.1. In Embu, the values are 4.6.-7.74 in the upper zones, whereas in the lower zones in Mbeere they range from 5.10-7.74. In Meru pH ranges from 4-7.16 as seen on Table 3.43. The implication is that in all the counties, fertilizer is a necessary requirement to enhance productivity either using acidic or alkaline fertilizers as per the Kenya Soil Fertility Report 2014.

Table 3.43: Summary of Soil Fertility Per Counties and Sub-Counties

MERU COUNTY												
Sub-County	**pH Ranges**	**TOC (%)Ranges**	**Nitrogen (%)**	**Available (ppm)**	**Potassium (me %)**	**Calcium (me %)**	**Magnesium (me %)**	**Manganese (me %)**	**Copper (ppm)**	**Iron (ppm)**	**Zinc (ppm)**	**Recommended Fertilizers**
Igembe North Sub County	5.8 – 6.85	1.0% – 4.3%	0.10-0.43	20-172	0.24-3.90	2.3-12.3	1.65-8.56	0.01-0.79	1.35-8.51	25.5-153	2.37-54.2	Non acidic fertilizers are recommended
Igembe South Sub County	4.3 – 7.00	1.-0% - 4.6%	0.10-0.46	6-250	0.06-19.7	0.1-6.9	0.02-8.31	0.01-0.64	0.50-6.53	10.1-115	1.49-25.0	Fertilizers containing potassium, calcium and magnesium should be applied
Imenti North Sub County	4.97 – 7.1	1.0% – 2.7%	0.11-0.32	7.6-269	1.14-7.54	1.0-5.3	1.04-7.15	0.12-7.54	2.26-49.2	12.4-102	3.24-77.0	Zinc fertilizers or using zinc-fortified NPK fertilizers is an important practice
Imenti South Sub County	5.0 – 6.7	1.0% – 2.9%	0.10-0.29	7-247	0.18-1.06	2,1-7.1	0.87-8.24	0.20-0.93	0.44-17.8	12.2-83.2	4.51-43.8	Fertilizers such as Calcium Ammonium Nitrate (CAN), Single Super Phosphate (SSP), and N: P: K 23:23:0, 20:20:0, etc. are recommended.
Tigania West Sub County	4.74 – 6.95	0.6% – 2.75%	0.06-0.25	1-210	0.22-2.87	0.7-14.1	0.08-8.50	0.12-1.05	0.08-10.9	10.7	1.05-47.6	Fertilizers such as Calcium Ammonium Nitrate (CAN), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, etc.

THARAKA NITHI COUNTY												
Sub-County	**pH Ranges**	**TOC Ranges**	**Nitrogen**	**Ppm**	**Potassium**	**Calcium**	**Magnesium**	**Manganese**	**Copper**	**Iron**	**Zinc**	**Recommended Fertilizers**
Maara Sub County	4.47 – 6.38	0.89% – 2.51%	0.09-0.25	19-122	0.14-1.50	0.9-4.3	0.21-5.56	0.22-1.11	0.24-15.0	14.6-63.6	1.63-42.5	Application of fertilizerwith micro-nutrient copper and zinc which is low in a few farms and lime to raise the pH and improve calcium and magnesium in the soil is required.
Meru South Sub County	4.41 – 7.16	0.59% – 2.59%	0.06-0.26	2-214	0.16-1.73	2.0-8.1	0.20-5.16	0.15-0.91	0.1-10.5	10.9-63.3	1.76-54.2	Application of fertilizer with micro-nutrient copper and zinc and lime to raise the pH and improve calcium and magnesium content in the soil is recommended.
Tharaka North Sub County	5.86 – 7.91	0.53% – 2.64%	0.06-0.27	2-280	0.05-1.87	1.3-7.3	1.38-8.43	0.13-0.90	1.02-10.3	5.81-96.7	0.70-5.10	Application of fertilizer with micro-nutrient zinc which is low in majority of the farms is recommended
Tharaka South Sub County	5.64 – 8.31	0.30% - 2.28%	0.03-0.23	3-248	0.12-1.62	0.7-16.9	1.16-7.26	0.09-0.45	0.4-8.78	14.7-227	0.94-18.8	Application of fertilizer with micro-nutrient zinc which is low in majority of the farms is required

EMBU COUNTY												
Sub-County	**pH Ranges**	**TOC Ranges**	**Nitrogen**	**Ppm**	**Potassium**	**Calcium**	**Magnesium**	**Manganese**	**Copper**	**Iron**	**Zinc**	**Recommended Fertilizers**
Embu North Sub County	4.79–6.71	0.83%-3.67%	0.09-0.35	6.0-137	0.14-1.24	2.0-5.3	0.21-5.34	0.01-0.62.	0.98-17.9	17.8-302	3.39-50	Fertilizers such as Triple Super Phosphate (TSP), Single Super Phosphate (SSP), compound fertilizers N: P: K such as 23:23:0, 20:20:0, 17:17:17, Calcium ammonium nitrate (CAN) and mavuno are recommended.
Embu West Sub County	4.62 – 6.16	0.78% - 2.36%	0.08-0.24	2.0-72	0.12-1.12	5.5-15.0	0.34-8.49	0.11-0.58	0.48-7.56	6.20-7.43	1.86-43.7	Fertilizers such as Triple Super Phosphate (TSP), Single Super Phosphate (SSP), compound fertilizers N:P:K such as 23:23:0, 20:20:0, 17:17:17, Calcium ammonium nitrate (CAN) and mavuno are recommended.
Mbeere South Sub County	5.10 – 7.74	0.47% - 1.88%	0.05-0.19	1-237	0.06-1.21	0.40-3.1	0.04-8.92	0.06-0.86	0.12-5.61	5.25-80.1	0.53-6.42	Fertilizers such as Triple Super Phosphate (TSP), Single Super Phosphate (SSP), compound fertilizers N: P: K such as 23:23:0, 20:20:0, 17:17:17, Calcium ammonium nitrate (CAN) and mavuno are recommended.
Mbeere North Sub County	4.71 – 6.58	0.48% - 2.07%	0.05-0.20	3-98	0.14-1.25	1.4-3.7	1.22-7.66	0.13-0.86	0.88-3.45	6.42-47.0	0.8-15.2	Fertilizers such as Triple Super Phosphate (TSP), Single Super Phosphate (SSP), compound fertilizers N:P:K such as 23:23:0, 20:20:0, 17:17:17, Calcium ammonium nitrate (CAN) and mavuno are recommended.

NYERI COUNTY												
Sub-County	**pH Ranges**	**TOC Ranges**	**Nitrogen**	**Ppm**	**Potassium**	**Calcium**	**Magnesium**	**Manganese**	**Copper**	**Iron**	**Zinc**	**Recommended Fertilizers**
Kieni East Sub County	4.86 – 7.5	1.2% - 4.2%	0.12-0.41	0.2-164	0.27-231	3.3-25.1	2.64-6.82	0.12-0.92	0.14-2.93	14.5-139	0.56-13.5	Fertilizers such as Calcium Ammonium Nitrate (CAN), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, etc. are recommended
Kieni West Sub County	5.2 – 8.1	1.33% - 3.56%	0.13-0.36	2-276	0.35-2.96	8.3-19.5	1.31-7.56	0.02-1.08	0.38-1.57	11.5-115	1.42-25.9	Fertilizers such as Calcium Ammonium Nitrate (CAN), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, etc. are recommended
Mathira East Sub County	4.64 – 6.4	<5.5%	0.15—0.26	7-91	0.08-1.09	0.7-5.9	0.28-6.08	0.11-1.09	1.41-72.2	15.2-139	2.22-42.0	Fertilizers such as Calcium Ammonium Nitrate (CAN), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, etc. are recommended
Mathira West Sub County	4.4 – 6.4	1.3% - 3.14%	0.13-0.31	7-151	0.08-2.27	1.1-6.9	0.33-7.60	0.17-1.6	0.41-37.2	14.7-113	3.31	Fertilizers such as Calcium Ammonium Nitrate (CAN), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, etc. are recommended
Mukurweini Sub County	4.4 – 6.56	1.05% - 2.45%	0.11-0.25	8-182	0.06-123	0.7-5.5	1.02-6.70	0.32-1.52	2.97-21.0	26.3-87.6	1.58-17.8	Fertilizers such as Calcium Ammonium Nitrate (CAN), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, etc. are recommended
Nyeri South Sub County	4.08 – 6.67	0.98% - 3.82%	0.1-0.38	5-222	0.10-2.07	0.6-17.1	0.03-8.41	0.03-1.36	2.95-322	12.5-143	3.10-127	Fertilizers such as Calcium Ammonium Nitrate (CAN), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, etc. are recommended

KIRINYAGA COUNTY												
Sub-County	**pH Ranges**	**TOC Ranges**	**Nitrogen**	**Ppm**	**Potassium**	**Calcium**	**Magnesium**	**Manganese**	**Copper**	**Iron**	**Zinc**	**Recommended Fertilizers**
Kirinyaga East Sub County	4.26 – 6.19	0.7% - 3.44%	0.07-0.34	4-132	0.04-1.07	1.0-7.5	0.08-6.99	0.50-1.45	0.31-38.6	11.8-241	1.76-24.4	Fertilizers such as Triple Super Phosphate (TSP), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, 17:17:17, Calcium ammonium nitrate, Mavuno, etc. are recommended
Kirinyaga South Sub County	4.16 – 7.14	0.56% - 3.82%	0.06-0.34	2-177	0.10-2.31	0.8-9.9	0.81-8.02	0.09-0.99	0.0-8.18	7.26-145	1.04-11.5	Fertilizers such as Triple Super Phosphate (TSP), Single Super Phosphate (SSP), N:P:K 23:23:0, 20:20:0, 17:17:17, Calcium ammonium nitrate, Mavuno, etc. are recommended

MURANG'A COUNTY												
Sub-County	**pH Ranges**	**TOC Ranges**	**Nitrogen**	**Available Ppm**	**Potassium**	**Calcium**	**Magnesium**	**Manganese**	**Copper**	**Iron**	**Zinc**	**Recommended Fertilizers**
Gatanga Sub County	4.31– 6.90	1.26% - 4.40%	0.13-0.45	10-215	0.22-3.92	0.6-14.9	0.02-7.22	0.30-1.75	0.4-175	26.2-160	2.56-34.4	Neutral fertilizers such as single super phosphate (SSP), triple superphosphate (TSP), calcium ammonium nitrate (CAN), Mavuno, compound fertilizers N:P:K 23:23:0, 20:20:0 etc. are desirable to be applied
Kandara Sub County	4.36 – 6.82	1.02% - 280%	0.10-0.27	17-200	0.24-2.79	1.3-7.9	0.55-6.45	0.15-1;08	1.78-130	14.7-78.9	2.15-45.9	Neutral fertilizers such as single super phosphate (SSP), triple superphosphate (TSP), calcium ammonium nitrate (CAN), Mavuno, compound fertilizers N:P:K 23:23:0, 20:20:0 etc. are desirable to be applied
Kangema Sub County	3.90 – 5.82	1.02% - 4.21%	0.10-0.42	11-177	0.06-1.75	0.5-5.9	0.01-5.35	0.02-0.78	0.31-96.1	24.1-175	1.90-38.4	Neutral fertilizers such as single super phosphate (SSP), triple superphosphate (TSP), calcium ammonium nitrate (CAN), Mavuno, compound fertilizers N:P:K 23:23:0, 20:20:0 etc. are desirable to be applied

Kigumo Sub County	4.40 – 6.55	0.96% - 4.90%	0.10-0.50	27-110	0.08-1.49	1.1-5.7	0.21-8.45	0.06-0.75	0.60-37.2	25.7-275	1.73-18.9	Neutral fertilizers such as single super phosphate (SSP), triple superphosphate (TSP), calcium ammonium nitrate (CAN), Mavuno, compound fertilizers N:P:K 23:23:0, 20:20:0 etc. are desirable to be applied
Murang'a South Sub County	4.74 – 6.38	0.92% - 2.75%	0.10-0.27	5-161	0.08-2.31	0.9-9.9	1.25-8.34	0.10-0.88	0.81-46.1	18.9-116	1.11-21.1	Neutral fertilizers such as single super phosphate (SSP), triple superphosphate (TSP), calcium ammonium nitrate (CAN), Mavuno, compound fertilizers N:P:K 23:23:0, 20:20:0 etc. are desirable to be applied

Source: The Kenya Soil Fertility Report 2014

3.4.5 Main Soil and Water Conservation Hotspots

The main soil and water conservation hotspots in Muranga County include Makuyu, Kambiti Kakuzi, Ithanga, Maragwa Ridge, and Githuuri. In Nyeri county it is concentrated in arid and dry lower parts on the eastern side of the county. According to the Nyeri CIDP, the areas are mainly affected by landslides due to poor farming practices on the hilly terrain, and encroachment on riverbanks. In Kirinyaga County, the hotspots are on the lower eastern side, while in Tharaka Nithi soil erosion affects many parts due to its hilly nature, and during the dry season most farmers lose their crops due to the loss of soil nutrients. Gullies and severe dryness of the soil is found in Kanduni Valley. During the study such severe gullies were noted in Lower Thanantu River Basin along the bridge to Kawethu, and underlying areas. In Embu County, soil and water conservation needs were noted in Thambana tributary, where the soil texture is loose, requires fertilizer to improve fertility and is prone to erosion

Overall, the household survey indicated that between 20% - 50% of farmers in most of the river basins acknowledged some problems on soil and water conservation. Subsequently, most of these farmers were using some form of soil and water conservation measures as seen in table 3.44 below.

Table 3.44: Soil Fertility and Soil and Water Conservation Measure per River basin

	Soil fertility on farm	Persons acknowledging problems of soil degradation in the river basins	Soil and water conservation measures used by farmers
Nairobi	Moderate	36.1%	Terraces(Bench ,Fanya Juu etc.), Use of Nappier grass as stabilizing materials on SWC structures ,Grass strips planting along contours
Rwamuthambi	Moderate	23%	
Mariara	Moderate	35%	
Sabasaba	Moderately high	44%	
Amboni	Moderately high	9%	
Ura	Moderate	25%	
Nyamindi	Moderate	25%	
Thika	Moderate	37%	
Maragwa	Moderate	34%	Terraces(Bench ,Fanya Juu etc.), Use of Nappier grass as stabilizing materials on SWC structures ,Grass strips planting along contours
Thangatha	Moderate	78%	
Thiba	Moderate to high	34%	
Mathioya	Moderate	62%	
Ena tributaries	Moderate	35%	
Maara	Moderately high	20%	
Thingithu	Moderate	23%	
Murubara	Moderately high	45%	
Ragati	Moderate	35%	
Rupingazi	Moderately high	9%	
Bwathunaro	Moderate	25%	
Thuci	Moderately high	44%	
Thanantu	Moderately high	45.0%	

	Soil fertility on farm	Persons acknowledging problems of soil degradation in the river basins	Soil and water conservation measures used by farmers
Muringato	Moderate	34%	Terraces(Bench ,Fanya Juu etc.), Use of Nappier grass as stabilizing materials on SWC structures ,Grass strips planting along contours
Kathita tributaries	Moderate	33%	
Kayahwe	Moderate	52%	
Ruguti	Moderately high	23%	
Chania	Moderately high	56.1%	

3.4.6 Soil and Water Conservation in the River Basins

As seen in table 3.44 above, the study noted that there are various soil and water conservation measures practiced within all the river basins which range from agronomic, vegetative, physical and overall management. Agronomic include plant and soil cover, conservation farming methods, and contour farming. Vegetative includes plant barriers (vegetative strips), live fences and windbreaks which are common in Kirinyaga and Meru County. Physical soil and water conservation structures involve construction of terraces, fanya juu, banks bunds, cut off and retention ditches, drains and barriers. Nappier grass is used to stabilize the soil and water conservation structures, while grass strips are also planted along contours. Overall management involves area closures, and selective clearing which is common in lower zones along Rupingazi River Basin where farmers have huge tracts of land.

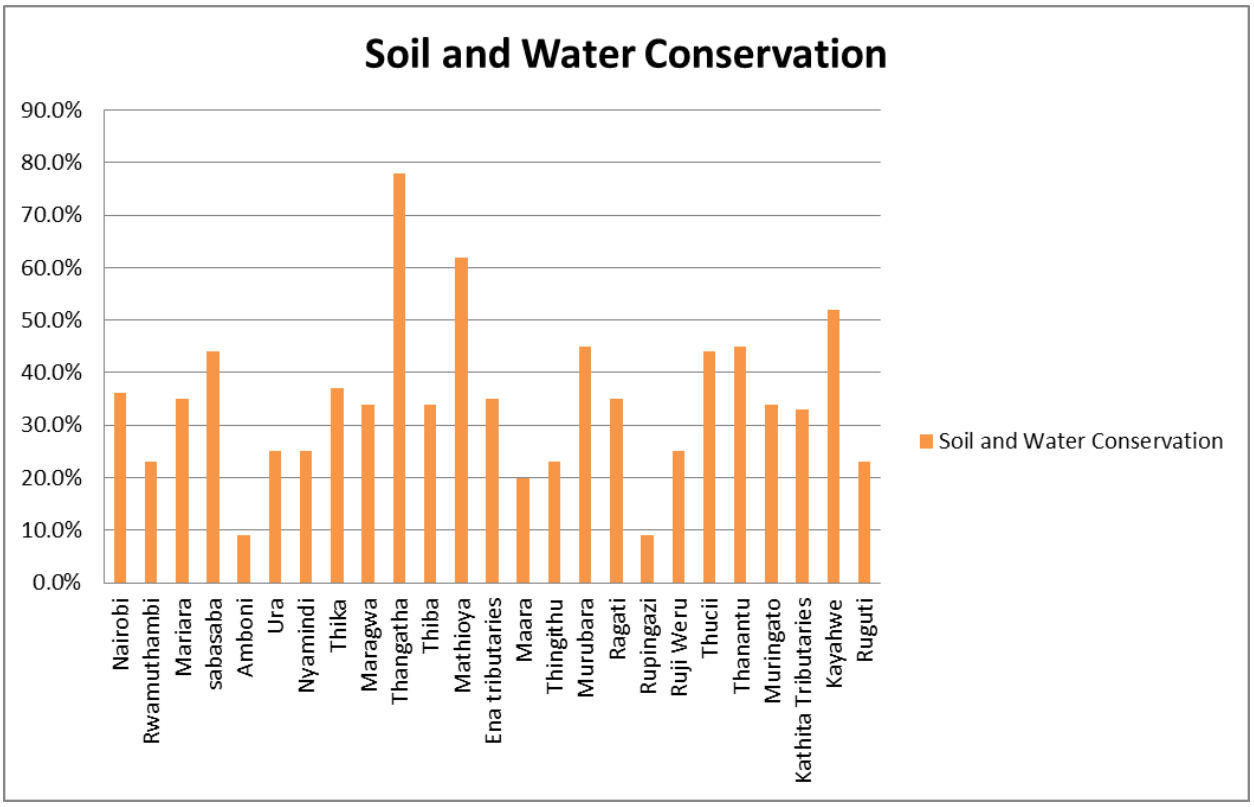
Notably also the soils within the basin are moderately fertile. However, to boost productivity, 78.7% of farmers use fertilizers. Respondents interviewed (34.6%) indicated that their farms had problems with soil and water conservationas seen in Figure 3.16. The methods used to address the issues included Biological (vegetative) methods i.e. grass strips, especially nappier grass (87%), and physical methods such as terraces (83%). Thangatha has the highest soil and water conservation issues due to poor farming practices, with the issue being addressed using terraces. As indicated in the Meru County Integrated Development Plan (2013, p. 29), the hilly terrain in Meru County where Thangatha River Basin lies has led to widespread soil erosion problems in the area.

Other River Basins that recorded high levels of soil and water conservation problems are Chania River with 56.1% of respondents indicating that there are problems with soil and water conservation with nappier grass, bench terraces and planting along contours being the most preferred methods of conservation. Another one is Kayahwe River Basin with 52% pointing out that there are problems with soil and water conservation, Also Thanantu and Murubara River Basins both had 45% of the respondents citing problems with soil and water conservation, and lastly Thuci with 44% pointing out the same problems. On the other hand Rupingazi River Basin recorded the least number at only 9% of respondents indicating that there are soil and water

conservation problems with nappier grass and bench terraces being the most preferred methods of conservation.

During the study it was noted that landslides are prevalent in Chania River owing to the steep land terrain, and the issue is addressed through planting of eucalyptus trees.

Figure 3.16: Soil and Water Conservation



3.4.8 Percentage of Farmers Using Improved Seeds and Fertilizer in the Counties and River Basins

The percentage of farmers using improved or certified seeds in the counties was fairly high as indicated in table 3.45below. Certified seeds were mainly used for maize growing and for horticultural use.

Table 3.45: Use of Certified Seed and Fertilizers by River Basin

River Basins	Use of Certified Seeds	Crops For Which Certified Seeds are used	Use of Fertilizers
Nairobi	100%	Maize, beans, sorghum, tomatoes	96.00%
Rwamuthambi	69%	Maize, green vegetables	81%
Mariara	87%	Maize, green vegetables	91%
Sabasaba	76%	Maize	83%
Amboni	87%	Maize and beans	78%
Ura	83%	maize, beans	67%
Nyamindi	100%	Maize, tomatoes, green vegetables	100%
Thika	85%	Maize	59%
Maragwa	79%	Maize, beans	81%
Thangatha	81%	Maize, beans, vegetables	78%
Thiba	87%	Maize	56%
Mathioya	87%	Maize	84%
Ena - tributaries	79%	Maize, beans, green vegetables	75%
Maara	81%	Maize beans, green vegetables	67%
Thingithu	72%	Maize, green vegetables	74%
Murubara	69%	Maize, tomatoes	74%
Ragati	87%	Maize, green vegetables	91%
Rupingazi	87%	Maize and beans	78%
Ruji weru	73%	Maize, beans	67%
Thuci	76%	Maize, sorghum, cow peas	74%
Thanantu	34%	Maize, beans, bananas	3.00%
Muringato	80%	Maize, green vegetables	80%
Kathita - tributaries	75%	Maize, tomatoes, green vegetables	59%
Kayahwe	87%	Maize,	92%
Ruguti	72%	Maize, green vegetables	74%
Chania	70%	Maize, beans, sorghum, tomatoes	62.00%

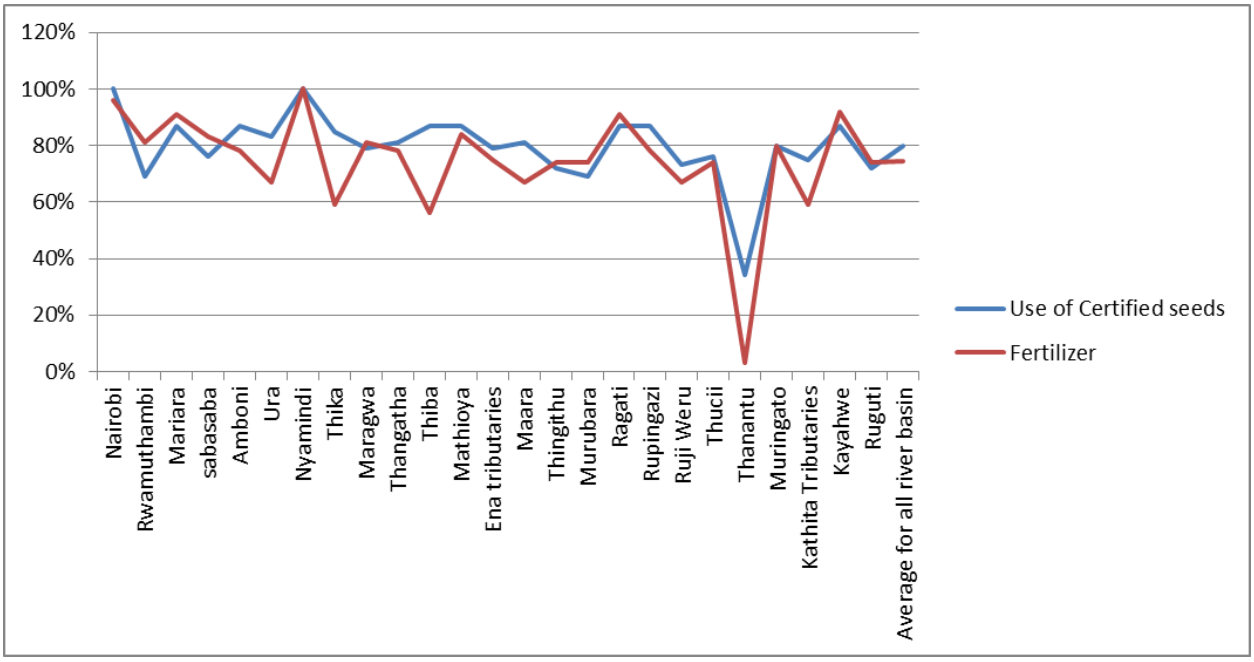
The use of certified seeds was highly noted in Nairobi and Nyamindi river basins which recorded 100%, and the lowest being in Thanantu river basin at 34%. The main certified seeds generally used are maize, beans, bananas, sorghum, cowpeas, tomatoes and kales. The certified seeds used in Nairobi River were mainly maize, beans and kales, whereas for Nyamindi they were maize, beans, green vegetables and tomatoes. In Thanantu river basin there was less use of certified seeds ostensibly because soils are fertile in the upper ecological zone. This lack of awareness resulted in low use of certified seeds as farmers thought this was not necessary due to the higher soil fertility. In the lower zone, which is mainly dry land, farmers are inclined towards growing sorghum and cowpeas and thus they mainly use own seeds.

The study findings indicate that there is a relationship between use of certified seeds and fertilizer application on farm. The trend shows that the more farmers use certified seeds, the more they also use fertilizers to improve yields. In Nairobi River Basin where the use of certified

seeds was 100%, the use of fertilizer was 96%. This declined drastically for Thanantu River Basin where the use of certified seeds was 34% and fertilizer 3%. On average for the 24 River Basins the use of certified seeds and fertilizers was 80% and 74.8% respectively as shown on figure 3.17.

According to a report by Kenya Horticulture Competitiveness Programme (Grow Kenya July 2013, Issue No. 34) farmers tend to use fertilizer in wet and rainy areas than in dry areas, due to production risks associated with dry seasons. Adequate rainfall stimulates crops to respond favourably to fertilizer and farmers tend to get certified seeds or better varieties to increase yields during this season. In dry areas or where water supply is inadequate, crops do not respond favorably and fertilizers may actually harm or burn the crop.

Figure 3.17 Farmers Using Certified Seeds and Fertilizers



3.4.7Uptake of Various Agricultural Technonologies

The average percentage of farmers using various technologies is Muranga County 65%, Nyeri 63%, Kirinyaga 45%, Tharaka Nithi 54%, Embu 40%, and Meru 52% as shown on table 3.46. Crop farming technologies were more in Muranga county and low in Tharaka Nithi at 65 and 23% respectively.

Table 3.46: Uptake of Various Agricultural Technologies

	OUT OF TEN FARMERS IN THE AREA, HOW MANY HAVE ADAPTED THE NEW TECHNOLOGIES (LIST PERCENTAGE)							
	AQUA-CULTURE	API-CULTURE	IMPROVED CHICKEN	RABBITS	PIGGERIES	DAIRY GOATS	TREE FARMING	COMMERCIAL FRUITS GROWING
Nairobi	0.02%	0.04%	0.04%	0.74%	0.00%	32%	10%	0.17%
Rwamuthambi	58%	31%	12%	50%	35%	15%	27%	42%
Mariara	7%	22%	28%	42%	7%	26%	35%	36%
Sabasaba	1%	1%	5%	4%	1%	7%	14%	15%
Amboni	8%	8%	18%	14%	20%	18%	18%	9%
Ura	50%	20%	40%	40%	30%	30%	80%	80%
Nyamindi	20%	20%	30%	20%	30%	33%	0%	20%
Thika	56%		23%	34%	34%	34%	1%	56%
Maragwa	0%	0%	56%	33%	24%	22%	34%	56%
Thangatha	33%	1%	69%	34%	35%	32%	58%	35%
Thiba	2%	45%	46%	37%	57%	3%	24%	23%
Mathioya	4%	6%	22%	26%	36%	35%	6%	5%
Ena tributaries	6%		7%	57%	17%	7%	3%	29%
Maara	5%	3%	27%	32%	36%	38%	44%	12%
Thingithu	5%	34%	22%	42%	7%	26%	38%	33%
Murubara	16%	23%	56%	6%	3%	25%	4%	11%
Ragati	2%	6%	34%	42%	23%	38%	11%	0%
Rupingazi	8%	8%	18%	14%	20%	18%	18%	9%
Ruji weru	10%	0%	0%	40%	30%	30%	0%	0%
Thuci	1%	1%	5%	4%	1%	7%	14%	15%
Thanantu	0.02%	0.040%	0.04%	0.74%	0.00%	2%	10%	0%
Muringato	58%	0%	0%	50%	0%	15%	0%	42%
Kathita tributaries	56%		23%	34%	34%	34%	1%	56%
Kayahwe	4%	6%	22%	26%	36%	35%	6%	5%
Ruguti	5%	34%	22%	42%	7%	26%	38%	33%
Chania	5.00%	0.000%	26.00%	34.00%	8.00%	18%	16%	0.17%

The study has established that farmers have adopted various technologies but with low uptake levels. It was noted that on average farmers are engaging in various technologies as follows: Aquaculture (17%) Apiculture (11%), Improved Chicken (23.2%), Rabbits (23%), Piggeries (28%), Dairy Goats 21.5%, Tree Farming (19.96%), and Commercial Fruit Growing (24.43%). A further 0.4% engages in other technologies.

Aquaculture is highly concentrated in Muringato, and Rwamuthambi both at 58% and Ura at 50%, whereas Thiba has the lowest at 2%. Fishing activities in Thiba are highly concentrated on the upper zone where farmers have established trout farming, due to the cold water temperatures.

Apiculture is practiced more in Thiba River Basin especially in the lower zone where 45% of farmers engage in the practice. This is mainly due to the conducive temperatures and pollen grains. Improved chicken was more practiced in Thangatha and Murubara River Basins with both recording 65% and Maragwa River Basin with 56%. Piggeries were practiced more in Thiba (57%), while dairy goats were noted to be high in Nairobi River Basin at 82%. Tree farming was high in Ura River Basin with 100% of respondents indicating that they were aware of farmers practicing it owing to conducive climatic condition and fertile soils, and availability of water. Commercial fruit growing was noted as being high in Amboni/Honi River Basin with 82% of respondents pointing out that they were aware of the practice, followed by Thika and Maragwa River Basins both at 56% and Gaciuma at 50%.

3.4.7.1 Green Houses

Green house farming is practiced in the River Basins but it ranges from low to medium. In the medium range were Ragati, where 26% of households use greenhouses mainly for tomatoes, while in in Chania (13%greenhouse usage) they mainly grow tomatoes, green vegetables In Muringato, 36% of respondents held that some people have green houses in which they mainly grow tomatoes and green vegetables, while in Ruji weru 21% held that there are people with greenhouses mainly for green vegetables. On the lower range were Kayahwe (2%), Kathita tributaries (3%), Rupingazi (4%), Thuci (5%) and Murubara with 8% using greenhouses mainly for tomatoes and vegetables.

The study also indicates that green houses in the River Basins are used for crop protection and enhancement. Among those who were interviewed, 20.5% indicated that they were aware of the use of green houses for crop protection and enhancement, whereas only 0.7% had adopted the technology (See figure 3.18), owing to the initial investment cost, which they indicated is prohibitive. The main crops grown in the green houses were green vegetables and tomatoes. However awareness levels were noted to be high in Nairobi, Thika, and Rupingazi River Basins, at 49%, 46%, and 35% respectively, with a corresponding adoption level of 12%, 11%, and 4% respectively as shown on table 3.47. During the study it was noted that in Thika River Basin there were more greenhouses specializing in horticultural farming mainly vegetables for export. Notable was Bendor Farm which specializes in flower farming, using Volcanic Pumis instead of soil, and recycling 40% of the water.

Figure 3.18: Green House Awareness and Adoption

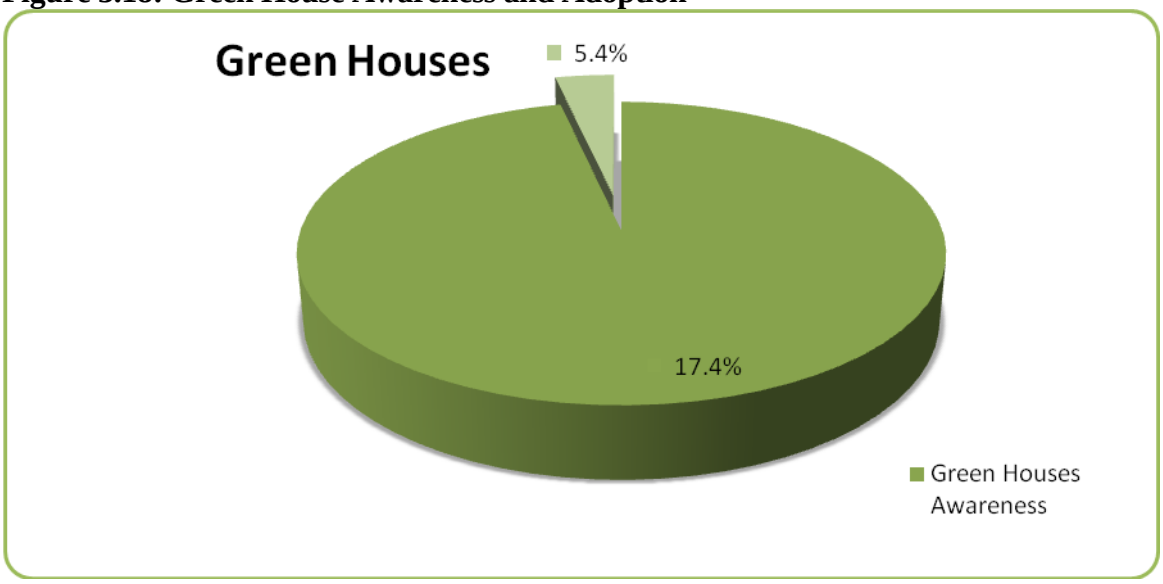


Table 3.47: Green House Utilization

	Awareness of farmers using green houses	Farmers using green houses for crop protection	Awareness	Horticulture farming
Nairobi	49%	12.0%	59.6%	36.1%
Rwamuthambi	12%	0%	73%	38%
Mariara	26%	0%	78%	74%
Sabasaba	5%	0%	10%	7%
Amboni	35%	4%	74%	35%
Ura	21%	0	86%	54%
Nyamindi	25%	8%	100%	100%
Thika	46%	11%	46%	26%
Maragwa	15%	3%	63%	48%
Thangatha	17%	6%	23%	34%
Thiba	8%	0%	35%	36%
Mathioya	16%	2%	52%	23%
Ena tributaries	31%	12%	26%	19%
Maara	13%	6%	12%	16%
Thingithu	0%	13%	23%	14%
Murubara	8%	16%	18%	14%
Ragati	26%	0%	78%	74%
Rupingazi	35%	4%	74%	35%
Ruji weru	21%	0%	86%	54%
Thuci	5%	0%	?	7%
Thanantu	10.0%	0%	60%	36.1%
Muringato	10%	0%	43%	38%

	Awareness of farmers using green houses	Farmers using green houses for crop protection	Awareness	Horticulture farming
Kathita tributaries	3%	3%	46%	26%
Kayahwe	16%	2%	52%	23%
Ruguti	0%	13%	23%	14%
Chania	32%	13%	37%	36.1%
Average for all river basins	**17.4%**	**5.4%**	**51.0%**	**37.6%**

Source: Study findings 2014

3.4.8 Major Cropping Activities, and Average Land Acreage in the River Basins

The average land acreage per HH is 4 acres which ranges from 1.8 acres in Thika river basin, to 2 acres in Ena, and 18 acres in Amboni river basin. This is because the Thika river basin has a higher population density, while Ena tributaries are characterized by settlements. On the other hand the Amboni basin is characterized by small farms in the upper zone whereas the middle and lower zones have large farms and ranches.

Food crops take an average of 47.3% of the land, cash crop take 29%, livestock occupy 16.3%, trees 18.3%, fallow takes 1.5%, and the rest of the land (1.5%) is reserved for other uses. Thangatha, Murubara and Mathioya river basins have the highest allocation of land for food crops which is 78%, 73%, and 72% respectively. The average land acreage allocated for food crops and cash crops varies as follows: Tea 1.14, Coffee 1.38, Bananas 0.81 Maize 2.44, Beans 1.23 and other crops 0.49. Mathioya and Maragwa river basins have the highest allocation of land per acreage on food crops at 10.6 and 10 respectively with the main crop being maize. Although Thangatha has the highest percentage of land allocated for food crops, it also has the highest land per acreage allocated to Tea production which is 5.56 acres. Indeed as the Meru County Integrated Development Plan (2013, p. 26) indicates 161,907.2 Ha of land in Meru County within which the Thangatha river basin is found, is allocated to food crops while 15, 773. 4 ha are under cash crops in the area.

In the Ena River Basin 56% of HH land is used for food crops, 14% cash crops, 7% trees, 6% livestock and 2% others. Maize leads with an average of 2.5 acres per HH farm, followed by Beans, 2.1 acres, Tea 1.6 acres, Coffee 1.3 acres, Bananas 0.6% and others 0.5 acres. Similar patterns are observed in most river basins in the area for instance in the Thingithu river basin 54% of land is used for food crops, 34% cash crops, 23% livestock, 3% trees and others account for only 4%. Nairobi river basin stands out has having the lowest acreage allocation for maize production which is 0.3% as seen on table 3.48. This is arguably because farmers are inclined towards vegetables, Irish potatoes and horticultural farming.

Table 3.48 Average Land Acreage and Crops Grown

	Avg. Acres	Tea	Coffee	Bananas	Maize	Beans	Others
Nairobi	4.4	0.01	0.07	0.04	0.30	0.20	0.08
Rwamuthambi	3.9	2.4	0.7	0.5	1.0	0.75	1.4
Mariara	1.9	0	0.6	0.4	10.6	0.4	1.2
Sabasaba	2.5	0	3	1.8	1	0.8	0.7
Amboni	18.3	0.5	0	0.3	1	1.25	1.2
Ura	3.5	0.25	0	1	0.75	0	0.625
Nyamindi	4.5	1	1	1	1	1	0.25
Thika	1.8	0	0	0.75	1	1	
Maragwa	3.7	4.6	0.6	0.5	10	2	0.8
Thangatha	1.43	5.56	1	0.6	5	3	
Thiba	5	0	0.3	0.3	4.6	3.6	0
Mathioya	2.6	0.4	0.4	0.2	1.3	0.9	0
Ena tributaries	2	1.6	1.3	0.6	2.5	2.1	0.5
Maara	5.5	1.5	2	0.6	1.7	1.4	0.6
Thingithu	4.3	1.4	6	0.7	4	2	0
Murubara	4.2	0	3.2	0.9	3	2	0
Ragati	2.6	1.5	0.3	0.3	1	0.4	0.3
Rupingazi	2.8	0.5	0.6	0.3	1	1.25	1.2
Ruji weru	3	0	0	1	0.75	0.4	0.625
Thuci	3	3	3	1.8	1	0.8	0.7
Thanantu	6.4	-	o.25	4.30	1	1	0
Muringato	2.3	2.4	0.7	0.5	1	0.75	1
Kathita tributaries	4.1	0	0.5	0.75	1	1	0
Kayahwe	3.6	0.6	1.4	0.4	1.4	0.7	0
Ruguti	4.8	1.4	6	0.7	4	2	0
Chania		1.20	0.7	0.40	0.80	0.20	0.20
Average for all river basin	**4.085**	**1.14**	**1.38**	**0.81**	**2.44**	**1.23**	**0.49**

Source: Study findings 2014

3.4.8.1 Maize Production

Maize is the most important cereal grain and staple food in the country and contributes significantly to food security. According to Economic Review of Agriculture 2013, by the Ministry of Agriculture, in 2012 maize production increased by 12 percent from 37.5 million bags achieved in 2011 to 41.8 million bags (90 Kgs bag). However, the area under production increased marginally by 1.3 percent from 2,131,887 Ha recorded in 2011 to 2,159,322 Ha in 2012. The production of green maize doubled in 2012 compared to 2011 while productivity also increased by 19.3 percent from 17.6 bags/Ha in 2011 to 21 bags /Ha in 2012. Muranga County has the highest hectarage (56,654) under Maize production and yields (70,086.51 tonnes), whereas Tharaka Nithi has the lowest hectarage (26,779) and yields (38,923.56 tonnes) as seen on table 3.49.

Table 3.49: Maize Production by Counties, 2012

County	Area (HA)	Production (90 Kg Bag) cereals	Estimate Production of Green maize	Total production (90 Kg Bag)	Yield Cereals (90 Bags/Ha	Green maize Proportion
Muranga	56,654	560,692	218,047	778,739	14	0.28
Nyeri	33,593	289,628	185,172	474,800	14	0.39
Kirinyaga	31,935	517,355	91,298	608,653	19	0.15
Tharaka Nithi	26,779	424,454	8,030	432,484	16.2	1.86
Embu	45,215	519,171	9,254	528,425	11.7	1.75
Meru	96,244	1,583,319	35,617	1,618,936	16.8	2.2

Source: Economic Review of Agriculture, 2014

3.4.8.2 Beans Production

1n 2012, according to Economic Review Report, the national output in beans production in 90kg bags was 7,162,132, with a total value of Kshs. 37.8 Billions. In the Counties Meru had the highest and Tharaka Nithi the lowest production of 595,179 and 113,519 of 90kg bags, respectively as indicated in table 3.50.

Table 3.50: Beans Production by Counties, 2012

County	Area (HA)	Production (90 Kg Bag)	Yield (90 Bags/Ha)
Muranga	37,908	354,449	9.4
Nyeri	24,583	195,415	7.9
Kirinyaga	21,103	211,402	10
Tharaka Nithi	15,815	113,519	7.2
Embu	23,758	169,670	7.1
Meru	79,093	595,179	7.5

Source: Economic Review of Agriculture, 2014

3.4.8.3 Rice Production

Nationally, Rice Production increased in the year 2012 to 126,399 tons from 111,229 tons in the year 2011. This increase is due to interventions being implemented by the Government and Stakeholders that are guided by the National Rice Development Strategy (NRDS) according to Economic Review of Agriculture 2013. Kirinyaga County had the highest hectarage (13,572) and Tharaka Nithi the lowest (15) and production was 80,075 and 49.5 tonnes respectively as shown on table 3.51. According to the National Irrigation Board, rice production in Kirinyaga County in 2013, increased from 80,075 to 90,000 tonnes and is expected to increase to 100,000 tonnes in 2014, due to the growing number of out growers near Mwea irrigation scheme.

Table 3.51: Rice Production by County, 2012

County	HA	Production (Tons)	Yield (Ton/Ha
Muranga	295.7	574	1.9
Kirinyaga	13,572	80,075	5.9
Tharaka Nithi	15	49.5	3.3
Embu	62	223.2	3.6
Meru	61	195.2	3.2

Source: Economic Review of Agriculture, 2014

3.4.8.4: Sorghum and Millet

Sorghum and Millet are one of the traditional crops that are drought tolerant grown in the country. The production of sorghum in increased from 1,776,412 bags in 2011 to 1,851,410 bags 2012 due to improved varieties. According to Economic Review for Agriculture 2014, Meru County had the highest hectarage (14,745) of sorghum with an output of 171,347 of 90 kg bags, with a yield of11.6 bags/Ha as indicated in Table 3.46. Meru County and Embu County followed at 174, 252, and 49,975 of 90kg bag respectively as shown in the tables below.

Table 3.52: Sorghum Production by County, 2012

County	Area (HA)	Production (90 Kg Bag)	Yield (Bags/Ha
Muranga	436.5	2,409	5.52
Nyeri	21.2	102	4.81
Kirinyaga	1,299.6	10,494	8.07
Tharaka Nithi	27,331	197,540	7.2
Embu	5824	46,155	7.9
Meru	14,745	171,347	11.6

Source: Economic Review of Agriculture, 2014

Table 3.53: Millet Production by County, 2012

County	HA	Production (90 Kg Bag)	Yield (Bags/Ha
Muranga	28.1	386.5	13.75
Kirinyaga	30	546	18.20
Tharaka Nithi	4,683	28,872	6.2
Embu	6,496	49,975	7.7
Meru	38,362	174,252	4.5

Source: Economic Review of Agriculture, 2014

3.4.8.5 Cowpeas, Green Grams, and Pigeon Peas

Cowpeas grow variably well in Arid Lands in Kenya. Its production since 2009 to 2012 has improved from 532,810 to 1,266,238 bags of 90 kg bags due to availability of certified seeds from the Ministry of Agriculture. Tharaka Nithi, which is predominantly an arid land, had the highest production at 143,065 bags of 90 kg bags as shown in Table 3.54. Green Grams production also was high in Tharaka Nithi at 238, 393 of 90 kg bags as shown on table 3.55. Pigeon peas did significantly well in Meru County (173,267 tons) than in Nyeri County at 108 tonnes respectively as seen on table 3.56.

Table 3.54: Cowpeas Production by County, 2012

County	Area (HA)	Production (90 Kg Bag)	Yield (Bags/Ha
Muranga	166.9	2,053	12.3
Nyeri	3.5	14	4
Kirinyaga	587.5	12,911	22
Tharaka Nithi	16,478	143,065	8.7
Embu	9,575	81,689	8.5
Meru	6,822	64,588	9.5

Source: Economic Review of Agriculture, 2014

Table 3.55: Green Grams Production by County, 2012

County	Area (HA)	Production (90 Kg Bag)	Yield (Bags/Ha
Muranga	11	135.5	12.3
Kirinyaga	364.5	1,930	5.3
Tharaka Nithi	25,582	238,393	9.3
Embu	7,899	49,783	6.3
Meru	6,086	52,507	8.6

Source: Economic Review of Agriculture, 2014

Table 3.56 Pigeon Peas Production by and County, 2012

County	Area (Ha)	Production (tons)	Yield (Tons/Ha)
Muranga	113.7	2338.5	20.6
Nyeri	10.5	108	10.3
Kirinyaga	240	1340.8	5.6
Tharaka-Nithi	6,696	54,338	8.1
Embu	745	6,133	8.2
Meru	15,826	173,267	10.9

Source: Economic Review of Agriculture, 2014

3.4.8.6 Sweet Potatoes, Cassava and Cocoyams

Sweet potatoes, cassavas and cocoyams were produced more in Meru county at 36,055, 24810, and 36,055 respectively. This is due to high allocation of hectarage for the crops, but the yields per hectare are significant in Kirinyaga 19.1 for sweet potatoes and Embu 13.9 for Cassava, and also Embu county 13 as shown in table 3.57.

Table 3.57: Sweet Potatoes Production by and County, 2012

County	Area (Ha)	Production (tons)	Yield (Tons/Ha)
Muranga	666	8,873	13.3
Nyeri	359	3,805	10.6
Kirinyaga	568	10,877	19.1
Tharaka-Nithi	614	7,995	13.0
Embu	357	4,735	13.3
Meru	3,020	36,055	11.9

Source: Economic Review of Agriculture, 2014

3.4.8.7 Cassava Production

The hectarage under Cassava production nationally increased from 60,473 in 2011 to 69,169 Ha in 2012 whereas production assumed the same trend, increasing from 679,167 in 2011 to 893,122 tons in 2012. Meru had the highest production of 24,810 tonnes, and Nyeri County the lowest at 24 tonnes as seen on table 3.58.

Table 3.58: Cassava Production by County, 2012

County	HA	Production (tons)	Yield (Tons/Ha)
Muranga	517.3	1784.9	3.5
Nyeri	35.7	24	0.7
Kirinyaga	174.8	175	1.0
Tharaka-Nithi	642	8,260	12.9
Embu	450	6,234	13.9
Meru	1,811	24,810	13.7

Source: Economic Review of Agriculture, 2014

3.4.8.8 Cocoyam and Yam Production

Cocoyam production and output has consistently increased since 2011, but a major increase of almost four times was observed on hectarage between 2011 and 2012. Average yield per Ha almost doubled from 6.7 in 2011 to 12.1 Tons/Ha in 2012. The hectarage under yam production reduced from 1,057 in 2011 to 10, 10 Ha in 2012. Likewise production reduced from 9,635 in 2011 to 9,144 tons in 2012 as shown in table 6.13. However average yield increased from 9.1 to 9.9 bags/Ha over the two years. Meru County had the highest production levels of both cocoyams and yams at 36, 055 and 6097 tonnes respectively. Embu and Kirinyaga counties had the lowest production levels at 4,735 (Cocoyams) and 24 (yams) tonnes respectively as seen on the following tables.

Table 3.59: Cocoyam Production by County, 2012

County	Area (Ha)	Production (tons)	Yield (Tons/Ha)
Tharaka-Nithi	614	7,995	13.0
Embu	357	4,735	13.3
Meru	3,020	36,055	11.9

Source: Economic Review of Agriculture, 2014

Table 3.60: Yams Production by County, 2012

County	Area (Ha)	Production (tons)	Yield (Tons/Ha)
Muranga	31.5	136.7	4.3
Nyeri	20.4	210.6	10.3
Kirinyaga	9	24	2.7
Tharaka-Nithi	103	1,040	10.1
Embu	111	1,126	10.1
Meru	624	6,097	9.8

Source: Economic Review of Agriculture, 2014

3.4.8.9 Wheat Production

Wheat production nationally increased from 268, 482 in 2011 to 441,754.3 tons in 2012. Wheat is mainly grown in Nyeri and Meru counties, and in 2012 the production levels were 54,722 tonnes and 459,850 tonnes respectively as shown in table 3.61.

Table 3.61: Wheat Production by County, 2012

County	Area (Ha)	Production	Yield (Bags/Ha)
Nyeri	5,252	54,722	10.4
Meru	15,265	459,850	30.1

Source: Economic Review of Agriculture, 2014

3.4.8.10 Horticulture Production in Upper Tana

Horticulture production in Kenya is becoming a major foreign exchange earner, and it is growing in hand in hand with small holders irrigation schemes. In 2013, the domestic value in the sector amounted to Kshs. 177 billion occupying an area of 605,000 Ha (340,000 Ha under vegetables) with a total production quantity of 132 million MT (National Horticulture Validation Data Report 2013). The growth in the sector is attributed to increase in improved farm gate prices particularly for vegetables, fruits as well as increase in small holder's irrigation projects which target horticulture farming in the counties. Horticultural production in the Upper Tana basin is dependent on availability of water for irrigation and is thus practiced depending on the number of irrigation schemes per river basin.

Table 3.62: Horticultural production in Upper Tana

	Percentage of farmers engaged in horticulture	Crops grown)	General yields of horticultural crops	Marketing of horticultural crops	Main challenges in horticulture
Nairobi	36.1%	Tomatoes, green vegetables, Beans	Moderate	Local Market, Middle men	Pests and Disease, market access, water shortage
Rwamuthambi	38%	Green vegetables and tomatoes	Moderate	Local Market, Middle men	Costly inputs, pests and diseases
Mariara	74%	Tomatoes, green vegetables, avocados	Average	Local Market, Middle men	Water, pests and diseases, transport
Sabasaba	7%	Passion fruits	Below average	Local market	Water, costly inputs
Amboni	35%	Potatoes, tomatoes, cabbages	Average to high	Local market	Pests and Disease, market access, wild life
Ura	54%	Tomatoes, green vegetables, bananas	Average	Local market, Brokers	Low yield, market access
Nyamindi	100%	Flowers, green vegetables, tomatoes	Average	Local Market, Middle men	Water shortages, pests and diseases, low prices
Thika	26%	Green vegetables and tomatoes	Average	Middle men, local market	Poor prices, pests and diseases
Maragwa	48%	Tomatoes, French beans, onions	Average	Local market	Pests and disease, water shortage, marketing
Thangatha	34%	Tomatoes, French beans,	Average	Local markets, brokers	Pests and diseases, water shortage, poor prices
Thiba	36%	French beans, sukuma wiki	Average	Local market, brokers	Pests and diseases, market access, water shortage
Mathioya	52%	Tomatoes, green vegetables,	Average	Local market	Diseases and pest, lack of water, costly inputs
Ena tributaries	19%	Green vegetables, tomatoes, onions, carrots	Average	Local market, brokers	Water shortages, pests and diseases, low prices
Maara	16%	Tomatoes	average	Local market	Diseases and pest, costly inputs
Thingithu	14%	Tomatoes, onions	Average	local market, Brokers	diseases and pests, low rainfall
Murubara	14%	French beans,, tomatoes	average	Local market	Diseases and pests, costly inputs
Ragati	74%	Tomatoes, green vegetables, avocados	Average	Local Market, (dominant) Middle men	Water, pests and diseases, transport
Rupingazi	35%	Potatoes, tomatoes, cabbages	Average to high	Local market	Pests and Disease, market access, wild life
Ruji weru	54%	tomatoes, green vegetables, bananas	Average	local market, Brokers	Low yield, market access
Thuci	7%	Passion fruits, tomatoes	Very low	Local market, brokers	Costly inputs

	Percentage of farmers engaged in horticulture	Crops grown)	General yields of horticultural crops	Marketing of horticultural crops	Main challenges in horticulture
Thanantu	36.1%	Green Grams	Low	Local Market, Middle men	Pests and Disease, market access, water shortage
Muringato	38%	Green vegetables and tomatoes	Moderate	Local Market, Middle men	Costly inputs, pests and diseases
Kathita tributaries	26%	Green vegetables and tomatoes	Average	Middle men, local market	Poor prices, pests and diseases
Kayahwe	52%	Tomatoes, green vegetables,	Average	Local market	Diseases and pest, lack of water, costly inputs
Ruguti	14%	Tomatoes, onions	Average	Local market, Brokers	Diseases and pests, low rainfall
Chania	36.1%	Tomatoes, green vegetables, Beans	Average	Local Market, Middle men	Pests and Disease, market access, water shortage

Most of the irrigation schemes in the river basins provide for farmers to irrigate between 0.25 – 0.5 of an acre. Based on the number of schemes with valid water permits, the area under irrigation in the Upper Tana river basis is 17,080 ha which if divided by approximately 0.25 acres works out to be about 150,000 farmers.

Table 3.63: Area under Irrigation (Ha)

River Basin	Permitted Area under Irrigation (Ha)
Ena (4EC)	108
Rupingazi/ Kapingazi (4DC)	256
Mutonga tributaries (4EA)	284
Kathita tributaries (4FA)	1710
Thika (4CB)	5846
Saba Saba (4BF)	48
Maragua (4BE)	11
Nairobi/ Sagana (4AA)	1336
Ragati (4BB)	477
Thiba/ Murubara (4DA)	5380
Thangatha (4FB)	169
Lower Chania (4CA)	268
Mathioya (4BD)	4
Amboni/Muringato (4AB)	150
Rwamuthambi (4BC)	385
Nyamindi (4DB)	94
Thuci/ Ruguti/Mara (4EB)	443
Ura/ Rujiweru (4FC)	111
Total	17,080

Source: WRMA Abstraction/ Permit Data Base May 2014

During the survey, farmers were not able to quantify yields of horticultural crops per se, and as indicated yields were generally given as average, high, or low. To determine actual yields, data from the counties were used.

In 2012, Meru County had the highest hectarage allocated to horticulture farming, and Tharaka Nithi the lowest which stood at 37,333.73 and 9,560.28 Ha, respectively. Crops grown were mainly tomatoes, cabbages, kales, carrots, bananas, mangoes, nuts (macadamia and groundnuts), and French beans. In Meru and Tharaka Nithi Counties, production was 890,099 MT, and 255,361.34 MT, at an estimated value of Kshs. 25 billion, and 4 billion, respectively as seen on Table 3.57. Kirinyaga County had 11,799 Ha allocated for horticulture farming, but performed better than Muranga county which had double the hectarage allocated for horticulture but earned only 1.2billion more than the former due to availability of water for irrigation. This is in agreement with section 6.12.3 on Yields and Incomes from Maize, Beans and Bananas of the study findings which shows that Thiba, Murubara, and Nyamindi River Basins in Kirinyaga County had higher yields per acre and income, due to availability of water for irrigation.

The overall performance per county in terms of tomatoes, cabbages, kales, carrots, bananas, mangoes, macadamia, peanuts and French bean are as shown in Tables 3.58 to 3.64 below. Meru county had the high highest output per hectare for tomatoes (52 tonnes/Ha), and Embu 2 tonnes per Ha. Cabbage production was high in Meru and low in Muranga County at 39.8 and 19 tonnes per Ha, respectively. Kale production was high in Tharaka Nithi (38.5/ha), and low in Kirinyaga at 6.7 tonnes per Ha. Carrot production was high in Meru County (29.7 tonnes/Ha) and Low in Muranga at 6.7 tonnes per Ha. Banana Production was high in Tharaka Nithi County at 72.1 tonnes per Ha, and low in Embu County at 0.2 tonnes per Ha. Mango production was high in Kirinyaga County at 16 tonnes per Ha, whereas in Nyeri production was 7.1 tonnes per Ha. Macadamia production was on average 5 tonnes per Ha, in all counties.

Table 3.64: Horticulture Performance by Counties 2010-2012

	2010			2011			2012			County percent share value-2012
County	**Area (Ha)**	**Quantity (MT)**	**Value Kshs (Million)**	**Area (Ha)**	**Quantity (MT)**	**Value Kshs (Million)**	**Area (Ha)**	**Quantity (MT)**	**Value Kshs (Million)**	
Muranga	13,990	209,826	7,019.07	16,421	184,588	6,364.73	25,806.58	572,738.17	10,691.18	4.9
Nyeri	12,779	258,870	3,659.11	10,262	179,911	3,152.65	29,211.79	173,739.30	2,901.12	1.3
Kirinyaga	10,137	252,395	4,212.14	10,621	299,970	4,511.70	11,779.00	375,416.05	9,384.14	4.3
Tharaka Nithi	32,496	258,438	3,151.26	36,821	285,461	5,523.08	9,560.28	255,361.34	4,383.95	2.0
Embu	11,851	308,585	3,079.63	12,205	251,386	5,556.44	14,227.17	221,980.51	3,980.59	1.8
Meru	43,452	657,699	29,123.57	47,468	631,474	30,326.91	37,333.73	890,099.60	25,831.68	11.9

Source: Economic Review of Agriculture, 2014

Table 3.65: County Tomato Production 2010-2012

	2010			2011			2012		
County	**Area (Ha)**	**Production**	**Value Kshs (Million)**	**Area (Ha)**	**Quantity (Ton)**	**Value Kshs (Million)**	**Area (Ha)**	**Quantity (Ton)**	**Value Kshs (Million)**
Muranga	904	15,743	748.8	1410.99	8916	207.1	255.3	9698.8	205.5
Nyeri	201	12,899	342.9	104	4550	154.5	93.8	2933	103.0
Kirinyaga	1,890	43,612	927.2	1638.8	44290	623.7	1917.8	54524	1070.2
Tharaka Nithi	228	480	14.4	24.2	1020	8.1	26	1100	5.5
Embu	632	16,470	340.7	239.9	3895	133.3	1681.5	4733	119.2
Meru	761	19,304	578.8	895.75	6658	99.2	420	22214	468.4

Source: Economic Review of Agriculture, 2014

Table 3.66: County Cabbage Production for 2010-2012

	2010			2011			2012		
County	Area (Ha)	Quantity (Ton)	Value Kshs (Million)	Area (Ha)	Quantity (Ton)	Value Kshs (Million)	Area (Ha)	Quantity (Ton)	Value Kshs (Million)
Muranga	294	5,376	230.8	312.37	5148.24	18.9	301.2	5931	48.0
Nyeri	1,205	56,458	544.6	1472	57566	591.8	1361	51503	539.4
Kirinyaga	111	5,227	100.1	102	3670	73.6	109.5	2723	69.6
Tharaka Nithi	418	308	4.1	20.5	802	13.6	32	1154	54.2
Embu	59	1,270	12.7	93	1547	17.8	91	2955	476.3
Meru	3,653	80,081	3664.7	322.5	4211	113.3	481.2	19165	476.3

Source: Economic Review of Agriculture, 2014

Table 3.67: County Kales Production 2010-2012

	2010			2011			2012		
County	Area (Ha)	Quantity (Ton)	Value Kshs (Million)	Area (Ha)	Quantity (Ton)	Value Kshs (Million)	Area (Ha)	Quantity (Ton)	Value Kshs (Million)
Muranga	355	4,565	47.8	661.7	1647.4	26.7	517.8	2456.5	27.6
Nyeri	210	6,819	67.4	162.1	2049	15.5	172.8	2165	18.3
Kirinyaga	184	1,633	16.0	128	727.2	9.3	115	776	11.8
Tharaka Nithi	689	1,208	26.9	23.2	896.4	16.2	28	1080	13.0
Embu	185	1,756	20.3	150	1724	22.2	154	3560	39.2
Meru	484	4,562	125.6	1247	12750	346.9	452	11791	636.5

Source: Economic Review of Agriculture, 2014

Table 3.68: County Carrots Production for 2010-2012

	2010			2011			2012		
County	Area (Ha)	Quantity (Ton)	Value Kshs (Million)	Area (Ha)	Quantity (Ton)	Value Kshs (Million)	Area (Ha)	Quantity (Ton)	Value Kshs (Million)
Muranga	20	59	27.0	27	112.88	4.5	26.9	179.7	5.2
Nyeri	240	8,158	98.0	135	1708.8	28.7	108.5	1509.8	25.1
Kirinyaga	7	233	5.3	11	360	6.1	8.66	298.8	15.1
Tharaka Nithi	126	29	0.7	7.5	214	8.6	11	248	11.9
Embu	172	2,480	49.4	91	1603	16.0	192	2325	5.4
Meru	1,051	21,316	191.5	854.7	8602.3	149.2	1048	31030	139.6

Source: Economic Review of Agriculture, 2014

Table 3.69: County Bananas Production 2010-2012

	2010			**2011**			**2012**		
County	**Area (Ha)**	**Quantity (Ton)**	**Value Kshs (Million)**	**Area (Ha)**	**Quantity (Ton)**	**Value Kshs (Million)**	**Area (Ha)**	**Quantity (Ton)**	**Value Kshs (Million)**
Muranga	5,188	91,973	0.0	8441.7	103340.7	1113.2	5754	113415	1434.6
Nyeri	1,083	22,242	275.5	1179	19191	238.4	1232.7	11404	253.6
Kirinyaga	4,089	140,195	0.0	3915.4	153742	1743.7	4148	160606	6586.5
Tharaka Nithi	388	11,595	0.0	1980	142248	1293.6	2077.5	149811	1327.6
Embu	4,287		0.0		65	0.0	384	295	0.0
Meru	5,027	124,793	0.0	5925	169913	9665.9	6241	315720	3256.0

Source: Economic Review of Agriculture, 2014

Table 3.70: County Mangoes Production 2010-2012

	2010			**2011**			**2012**		
County	**Area (Ha)**	**Quantity (Ton)**	**Value Kshs (Million)**	**Area (Ha)**	**Quantity (Ton)**	**Value Kshs (Million)**	**Area (Ha)**	**Quantity (Ton)**	**Value Kshs (Million)**
Muranga	634	2,084	77.1	797	4922	52.4	804	6390	66.6
Nyeri	42	292	7.1	57.7	374	10.5	60	430.3	16.6
Kirinyaga	161	3,742	92.9	82.2	2211	42.7	73.7	1179.2	29.5
Tharaka Nithi	4,797	12,749	0.0	1950.52	6031.5	86.5	1228.98	14747.7	368.7
Embu	3,553	23,488	0.0	3164	31916	513.8	3744.33	42995	1074.9
Meru	3,349	51,751	0.0	3967	44922	299.4	2192.5	26309.7	657.7

Source: Economic Review of Agriculture, 2014

Table 3.71: Macadamia Nuts Production 2010-2012

County	2010			2011			2012		
	Area (Ha)	Quantity (Ton)	Value Kshs (Million)	Area (Ha)	Quantity (Ton)	Value Kshs (Million)	Area (Ha)	Quantity (Ton)	Value Kshs (Million)
Muranga	258	640	46.68	342.3	1604	87.20	1343.3	6380.5	404.24
Nyeri	207	2,146	64.57	300	1486	74.20	309	1533	107.80
Kirinyaga	137	957	41.43	146	876	59.46	165	875	68.57
Tharaka Nithi	337	2,489	199.12	362	1448	72.40	485.6	2428	121.40
Embu	697	2,885	340.63	735	3675	183.75	726	3993	199.65
Meru	619	4,989	225.20	443.5	2487	140.60	494.5	2758.5	137.93

Source: Economic Review of Agriculture, 2014

Peanuts: Peanuts which are also referred to as groundnuts, are classified as horticulture crops, under the category of nuts (macadamia, cashew and bambara nuts) is ranked among the fourth most suitable crop for the semi-arid areas of Kenya. According to the National Horticulture Validated Report (2013), the area under peanuts was 17,311 Ha, a production of 94,042 Metric Tonnes valued at Kshs. 4 Billion, some of which is produced in in little quantities in semi-arid areas such as Tharaka Nithi County which has 222 Ha, and produced 4011 MT. The challenge with peanut production is inadequate quality, and low adoption of Good Agricultural Practices.

Table 3.72: Peanut Production in Meru and Tharaka Nithi County 2013

County	**Area (Ha)**	**Quantity (MT)**	**Value (Kshs. Millions)**	**% Share by Value**
Meru	606	1900	120.98	3
Tharaka-Nithi	222	4,011	722.10	18
Comparative Counties				
Migori	4,293	11,549	1,142.79	28.5
Bungoma	2048	23,844	1,021.36	25.5

Source: Economic Review of Agriculture, 2014

French Beans: French bean is primarily grown for exports with an insignificant quantity consumed in the domestic market. The production of crop had dwindled in the recent past owing to interceptions and rejection of the crop in the export market due to overuse of chemicals by farmers surpassing the Maximum Residue Levels(MRLs) imposed by the European Union. In that regard exporters of the crop have resorted to contractual farming where farmers grow the crop in small portions of land measuring 200square feet, in order to monitor the quality of the crop as was the case in Upper Thingithu, River Basin, by Fintrec and Vegpro companies.

However the trend has improved since 2012 owing to the quality requirement of the EuroGap standards especially traceability supply as earlier mentioned enabling exporters to monitor chemical use by farmers directly. Kirinyaga County had the highest hectarage allocated to French bean farming and Embu the lowest, at 1514 and 176 respectively as seen on table 3.73. Kirinyaga also produced 15,220 MT, and this is attributed to availability of water for irrigation.

Table 3.73: French Beans Production in Selected Counties

County	Area (Ha)	Quantity (metric tonnes)	Value KShs. (millions)	% Value Share
Kirinyaga	1514	15220	869.4	47.7
Muranga	885.0	4731	158	8.7
Meru	367	3328	130.3	7.1
Embu	176	2083	124.2	6.8
Nyeri				

Source: Economic Review of Agriculture, 2014

Horticultural awareness within the 24 River Basins on average is 51%, where farmers who have adopted the practice are 38% with 11% who are uninformed. Awareness levels are high in Nyamindi, Rwamuthambi, Ura and Ragati River Basins with 100%, 86% and 78% respectively. On the other hand adoption levels in those River Basins are 100%, 54% and 74% respectively. The food crops grown are mainly tomatoes, green vegetables, French beans, passion fruits, bananas and onions.

In some parts for instance in Thangatha and Ura River Basins there are cases in which some farmers are shifting from the traditional cash and food crops to horticultural production especially in the Nyambene ranges according to the Meru County Integrated Development Plan 2013-2017

3.4.9 Challenges

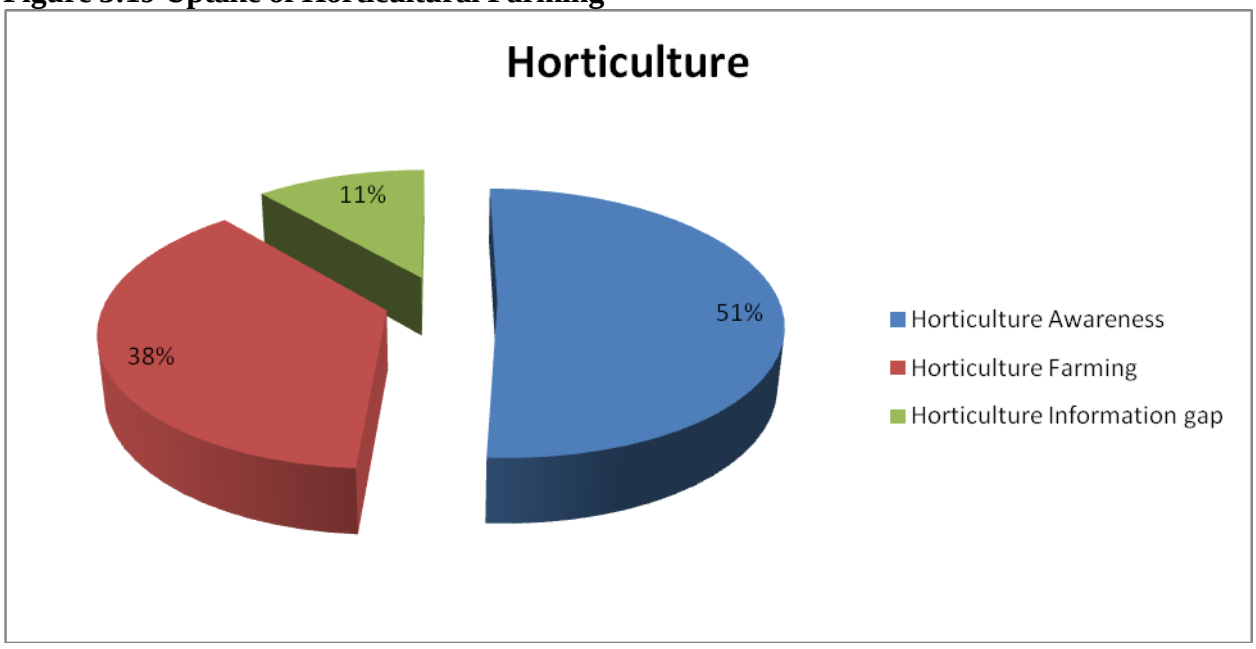
On average the main challenges to horticultural farming were diseases and pests, low rainfall, low prices, and market access. During the study, a case study identified is a commercial passion fruit farming project which had been initiated in Upper Thingithu River Basin in Ikuu Location. This was on passion fruit farming as well as passion fruit nurseries but it also faces challenges of pests and diseases. The project was initiated in 2005, with the aim of supplying fruits to the East African Growers, but was affected by pests and diseases and in 2008-09 it failed due to the same problem of pests and diseases. In 2010, Kenya Agricultural Research Institute (KARI) came in to assist and built a gauze nursery to support the project, under Guneke Self Help Group, despite the fact that the group membership declined from 40-17members currently due to decline in income. However, the passion fruit nursery is still active and the members have been able to

plant seedlings on their farms, but the main challenge remains pests and diseases. What was notable is that gauze is critical in securing passion fruit farms from pests and diseases. In addition, it was noted that despite market access, favourable pricing (contract marketing), conducive environment, projects growth can be affected by pests and diseases and information gap as seen on figure 3.19.

Other challenges in horticulture include storage facilities for after harvest. The study noted that in Nairobi and Sagana River Basins farmers were losing crops (mainly potatoes and cabbages) due to lack of cold rooms for horticulture crops as they depend on direct sales, and surplus is discarded, if not collected. During the high season an average cabbage costs Kshs. 5 and Kshs. 20 during dry season, despite the fact that in urban centers the price is five times higher especially in Nairobi.

In most River Basins especially within Meru County poor marketing systems as proved a serious challenge. According to the Meru County Integrated Development Plan (2013-2017, p. 23), middlemen have been specifically pointed out as threat to the sector. On the other hand according to the Tharaka Nithi County Integrated Development Plan (2013-2017) diseases and pests, poor farming methods and frequent droughts are major threats to the agricultural sector.

Figure 3:19 Uptake of Horticultural Farming



3.4.10 Livestock

The main livestock breeds within the 24 River Basins are Freshian, Guernsey, Ayshire, Boran, Sahiwal, and crosses of the same. Small stock comprise of goats, dairy goats, and sheep. Others are pigs, rabbits, improved chicken (broilers and layers), and indigenous chicken. Livestock is reared through zero grazing in the upper and middle zones, whereas in the lower zones free range is the preferred method. The preferred breeding method is Artificial Insemination (AI) but also Bulls are in use in some parts especially the lower zones for instance in lower Thiba River Basin. Farmers have various options such as local AI, or government veterinary services. In Embu and Meru, the Catholic Diocese plays an important role in availing AI Services to farmers. The main challenges are pests and diseases, which are controlled through hand spraying, which has replaced cattle dips. Another major challenge is shortage of fodder especially in the upper zone where zero grazing is practiced due lack of land.

In some parts of the River Basins for instance Thanantu, Ruji weru and Thangatha livestock farming is practices in group ranches for example in Tigania and Igembe areas as indicated in the Meru County Integrated Development Plan, 2013-2017, p. 23).

3.4.10.1 Livestock Population per County

The livestock development sub-sector contributes to about 42 per cent of agricultural GDP and about 10 per cent directly to the overall GDP. It also accounts for about 30 per cent of total agricultural products, which earn the country foreign exchange through the export of live animals, dairy products, hides and skins.

The main breeds of cattle found in the Muranga, Nyeri, Kerugoya, Embu, Tharaka, and Meru are Freshian, Guernsey, Ayshire, Boran, and Sahiwal. Small stock comprise of goats, dairy goats, and sheep. Others are pigs, rabbits, improved chicken (broilers and layers), and indigenous chicken. The breeding, feeding, health care and management practices followed by the livestock keepers have important bearing on the production performance of the animals.

3.4.10.2 Cattle

The breeding, feeding and management practices followed by the dairy farmers are broadly the same for both dairy cows and bulls and have little variation. The upper zones farmers prefer dairy cows which are reared under zero grazing due to land constraints, whereas in the middle and lower zones farmers prefer both dairy and meat cows which are reared in ranges, because of availability of land and fodder. Breeds consist of Freshian, Guernsey, Ayshire, Boran, Sahiwal, and crosses of the same.

Breeding practices: farmers who practice dairy farming prefer Artificial Insemination, and this is sourced from Government Veterinary Officers, or the Catholic Diocese of Embu and Meru which also provides such services. The commercial dairy farmers in urban and peri-urban areas and some farmers in rural areas, who expect higher milk production, prefer to mate their cows with their own graded bull and offer breeding services to others.

Feeding practices: As in most parts of the country, the animals usually subsist on grass, crop residues and locally available feeds and fodder which is a common practice in the Upper Zone. In the middle and lower zones the animals are dependent on grazing which is mainly in the ranges and cropped fields during off-season.

3.4.10.3 Goats

Goats are generally reared under semi-scavenging system except for a very small number of breeds which are kept under intensive conditions, especially dairy goats.

Breeding practices: In rural areas, indiscriminate breeding practices are followed. Just as in the case of cattle, bucks are also let loose in the village and roam around freely except where the bucks are two dairy goats. Breeds, consist of mainly Toggenburg with few other species like the German Alpine.

Feeding practices: Nearly all goats graze during day time. In the evening, they are provided with kitchen wastes such as leftover vegetables, starch etc. Households also collect leaves of trees which serve as feed. During the cultivation period and rainy season, the movement of goats is restricted to the home premises or common property resources especially in areas where there is shortage of grazing land.

Management practices: Goats are not penned in any shed. Rather, they are tethered in the home premises in the evening and are often taken for grazing by children. Dairy goats are housed in pens.

3.4.10.4 Pigs

Pigs are often confined to home premises in enclosures made out of locally available material particularly in urban or peri-urban areas or areas having intensive agriculture. In rural areas where cropping land is not in the vicinity, pigs are let loose to scavenge in and around the home premises or on the road side.

Breeding practices: Pigs are bred by natural service, either with an indigenous boar or a cross breed. Due to unsystematic breeding practices, crossbred pigs are not of any particular breed.

Feeding practices: Pigs are mainly fed with kitchen waste and scavenge on tubers of colocasia, tapioca and grasses collected from the jungles. Purchased feed is mainly used by commercial farmers but is not too common among small holders due to financial constraints or lack of availability in the market. In the peri-urban areas, hotel waste is used as feed.The management and health care of pigs is as unsystematic as their breeding and feeding practices.

3.4.10.5Poultry

The indigenous breeds are reared as backyard poultry, while the improved breeds of broiler and layer birds are kept under intensive conditions.

Breeding practices: In local backyard poultry, almost every household has a mixed herd of cocks and hens which breed freely (flock mating) without any controlled breeding.

Feeding practices: Indigenous birds scavenge throughout the day in and around the homestead feeding on broken maize, other crop residues and kitchen waste. Feeds are generally not purchased. Commercial birds are reared on balanced concentrate feed which is purchased. Commercial farmers vaccinate the birds regularly resulting in lower mortality.

Table 3.74: Livestock in Meru County

	Type	Imenti North	Meru Central	Imenti South	Tigania	Igembe
1	Cattle	84,555	57,108	54,240	97,740	108,661
2	Sheep	72,865	24,524	15,755	29,995	25,083
3	Goats	46,724	31,093	40,921	94,750	100,052
4	Camels	49	2	4	2529	1448
5	Donkeys	2,371	862	409	5,325	5,260
6	Pigs	4,320	2,010	1,822	8,053	4,401
7	Indigenous Chicken	212,865	131,170	123,687	227,334	199,324
8	Chicken Commercial	49,956	22,164	35,025	18,812	28,356
9	Bee Hives	10,158	14,556	17,377	28,225	16,731

Source: Open data Survey 2014, www.opendata.go.ke

Table 3.75: Livestock in Tharaka Nithi County

	Type	Tharaka	Maara	Meru South
1	Cattle	63444	32522	36,893
2	Sheep	31,961	10,418	192,283
3	Goats	142,813	36,423	52,354
4	Camels	12	6	2
5	Donkeys	5,444	188	486
6	Pigs	980	4,030	4,575
7	Indigenous Chicken	135,417	99,410	123,515
8	Chicken Commercial	5,692	16,724	15,940
9	Bee Hives	77,383	18638	33942

Source: Open data Survey 2014, www.opendata.go.ke

Table 3.76: Livestock in Embu County

	Type	Embu	Mbeere
1	Cattle	67,052	86,648
2	Sheep	20,716	26,834
3	Goats	54,116	166,679
4	Camels	2	11
5	Donkeys	579	7,234
6	Pigs	5,021	1,347
7	Indigenous Chicken	234,489	202,410
8	Chicken Commercial	52,217	14,675
9	Bee Hives	26,972	74,004

Source: Open data Survey 2014, www.opendata.go.ke

Table 3.77: Livestock in Nyeri County

	Type	Nyeri North	Nyeri South
1	Cattle	128,193	94,053
2	Sheep	136,947	31,862
3	Goats	46,557	56,369
4	Camels	78	10
5	Donkeys	2,219	1,064
6	Pigs	5,773	7,811
7	Indigenous Chicken	283,681	229,956
8	Chicken Commercial	67,995	84,385
9	Bee Hives	9,256	6,743

Source: Open data Survey 2014, www.opendata.go.ke

Table 3.78: Livestock in Muranga County

	Type	Muranga North	Muranga South	Gatanga
1	Cattle	102,573	112,181	28,494
2	Sheep	21,865	25,974	6,480
3	Goats	86,808	82,937	17,402
4	Camels	-	4	-
5	Donkeys	930	2,066	302
6	Pigs	3,843	14,336	4,105
7	Indigenous Chicken	246,041	365,272	71,439
8	Chicken Commercial	89,409	280,819	144,862
9	Bee Hives	6,019	25,643	1,832

Source: Open data Survey 2014, www.opendata.go.ke

Table 3.79: Livestock in Kirinyaga County

	Type	Kirinyaga
1	Cattle	144,112
2	Sheep	27,642
3	Goats	101,596
4	Camels	7
5	Donkeys	3,990
6	Pigs	10,606
7	Indigenous Chicken	465,455
8	Chicken Commercial	82458
9	Bee Hives	10,227

Source: Open data Survey 2014, www.opendata.go.ke

3.4.11 Market for Food Crops, Cash Crops, Horticulture, and Livestock

The market for food crops within all the River Basins is basically the local market, where it is bought by locals or middle men and sold to the tertiary market. Cash crops, mainly tea and coffee, are sold to the factories within localities where farmers are members. Horticultural crops grown are mainly French beans, avocadoes, bananas, passion fruits, onions and vegetables. The distance from the farm to the market ranged from the farm gate to 100 km in all the river basins. The livestock market also ranged from the local to distant markets: in Sabasaba river basin it ranged from 1-80 km, up to Kangari where there is livestock market. The market for small stock was noted in Kathwana in Tharaka Nithi County, covering Maara, Ruguti, and Thuci basins.

Table 3.80: Milk Yield and Market

	Milk yield per day per animal	Price	%Selling through dairy groups	Membership in Agro-processing organizations (%)	Membership in marketing groups (%)
Nairobi	6	25-40	6	4.2	4.2
Rwamuthambi	5.6	25-40	15	8	8
Mariara	3.7	30-70	35	13	8
Sabasaba	4.5	27-60	2	0	0
Amboni	12	20-40	48	43	9
Ura	7.6	20-40	17	17	25
Nyamindi	7.5	25-40	42	33	25
Thika	8	32-60	1	0	0
Maragwa	5.6	25-53	4	45	34
Thangatha	5	20-50	4	57	5
Thiba	3.5	25-65	12	0	4
Mathioya	2.8	25-50	56	0	46
Ena - tributaries	5	25-50	48	4	53
Maara	3	30-45	34	8	36
Thingithu	5	30-45	23	0	23
Murubara	4	20-40	28	6	34
Ragati	3.7	30-70	35	13	8
Rupingazi	12	20-40	48	43	9
Ruji weru	7.6	20-40	17	17	25
Thuci	4.5	27-60	2	9	36
Thanantu	5	25-50	6	4.2	0.0
Muringato	8	25-40	8	8	8
Kathita tributaries	6	32-60	23	3	3
Kayahwe	2.8	25-50	56	0	46
Ruguti	5	27-60	23	0	23
Chania	6	25-45	4	0	4
Average	**5.8**	**20-70**	**25%**	**49.1%**	**18.9%**

Source: Study findings 2014

3.4.12 Access to Credit

Most farmers can access credit from a variety of financial institutions including commercial banks, micro-finance institutions and Savings and Credit organizationsin all River Basins. All the available financial institutions give credit to farmers. According to this study Equity bank is leading in giving credit, with 59% of respondents indicating that they have access to credit. In Ruji weru and Thuci 80%; of respondents have accessed credit, while in Murubara, Rupingazi,

Thanantu, Ruguti and Ragati basins it was 70% ; Ena, Muringato and Ngaciuma river basins 60%; Thingithu and Kayahwe basins 50%; and Chania 40%.

The major challenge is not the access of credit but the conditions for accessing the same and difficulties in repayment. The conditions for accessing credit are mainly collateral, savings, security for instance in terms of land title deeds and guarantors. Most people in the River Basins have bank accounts and also most of the Self Help Groups practice table banking as indicated in table 3.81. Table banking or Rotating Savings and Credit Associations (Rascals) are mutual membership clubs registered as social welfare groups. The members pool resources, which they lend to individual members in turns.

Table 3.81: Access to Credit

	Banked (%)	**Persons undertaking Table Banking****	**Main Source of Credit**	**Share of market**
Nairobi	91.5%	51%	SACCOs, microfinance	51%
Rwamuthambi	100%	54%	Equity	54%
Mariara	100%	74%	Equity	74%
Sabasaba	44%	66%	Equity	66%
Amboni	96%	87%	Taifa SACCO	87%
Ura	86%	87	Equity	
Nyamindi	93%	98%	Bingwa SACCO	80%
Thika	70%	63%	Equity	63%
Maragwa	91%	45%	Murata SACCO	45%
Thangatha	90%	75%	Meru north farmers SACCO	75%
Thiba	76%	67%	Equity	67%
Mathioya	92%	72%	Murata SACCO	72%
Ena tributaries	89%	62%	Equity	62%
Maara	78%	59%	SACCO	59%
Thingithu	79%	24%	Equity	24%
Murubara	81%	39%	Equity	39%
Ragati	100%	43%	Equity	43%
Rupingazi	96%	81%	Equity	81%
Ruji weru	82%	47%	Equity	47%
Thuci	82%	90%	Equity	90%
Thanantu	91.5%	35%	Meru North SACCO	35%
Muringato	96%	76%	Equity,	76%
Kathita tributaries	70%	24%	KWFT	24%
Kayahwe	100%	24%	Equity	24%

	Banked (%)	Persons undertaking Table Banking**	Main Source of Credit	Share of market
Ruguti	79%	47%	Equity	47%
Chania	73%	77%	Equity	42%
Average for all river basins	**86.4%**	**59%**	**Equity**	**59%**

**Table banking or Rotating Savings and Credit Associations (ROSCAs) are mutual membership clubs registered as social welfare groups. The members pool resources, which they lend to individual members in turns

Source: Study findings 2014

3.4.13Productivityand Incomes Per Unit Area

Productivity per unit area is not uniform, neither are prices fetched per crops which thus impact on income levels per area of crop. Average figure have thus been used.

On the whole, horticulture, followed by rice was the biggest sources of income per unit area. Using the crop production figures in table 3.51 for rice and 3.64 for horticulture, average incomes per hectare per year are Kshs 286,400 and 467,000 for rice and horticulture for the Upper Tana basin. Horticulture incomes however rise to as high as Kshs 796,000 and 692,000 per hectare per annum in Kirinyaga and Meru respectively; while those for rice are also higher in Kirinyaga at Kshs 480,000.

The average maize yields for all river basins was 17 (90kg) bags owing to variation on acreage allocated for production, and the average production per acre was 7 (90kg) bags. At an average price of Kshs 3,233 per bag, average incomes per acre per annum was Kshs 22,011 per annum (Kshs 54,374 per hectare).

The average yield of beans per acre for all the river basins is 4 (90kg) bags, while averageproduction per ha is about 3 (90Kg) bags. This gives an average income of Kshs 20,714 per acre per annum (Kshs 51,164 per hectare per annum.

The average yield for Bananas was 11.4 tonnes in all river basins and the average yield per acre was 14 tonnes per acre. At Kshs 23,204 per tonnes, the average income per acres was Kshs 325,538 per acre per annum (Kshs 804,079 per hectare per annum).

Table 3.82: Maize Yields and Income Per River Basin

River Basin	Average acreage (acre)	Maize Area (acres)	Maize yield per County(90kg bags/ha)	Average output per river basin (No. of 90kg bags)	Average yield per acre (No. of 90kgbags/acre)	Average income per river basin (Kshs) @ Kshs 3233 per 90 Kg bag	Average income per acre (Kshs)
Nairobi	4	0.3	14	2	6	5,651	18,835
Rwamuthambi	4	1.0	19	8	8	25,066	25,066
Mariara	2	0.5	14	3	6	9,418	18,835
Sabasaba	3	1.0	14	6	6	18,652	18,652
Amboni	18	1.0	14	6	6	18,704	18,704
Ura	4	0.8	19	6	8	18,652	24,869
Nyamindi	5	1.0	19	8	8	25,066	25,066
Thika	2	1.0	14	6	6	18,691	18,691
Maragwa	4	1.0	14	6	6	18,691	18,691
Thangatha	1	0.5	19	4	8	12,435	24,869
Thiba	5	4.6	20	36	8	117,409	25,524
Mathioya	3	1.3	15	8	6	24,673	18,979
Ena tributaries	2	2.5	13	14	5	44,012	17,605
Maara	6	1.7	18	12	7	40,186	23,639
Thingithu	4	4.0	19	31	8	99,477	24,869
Murubara	4	3.0	19	23	8	75,197	25,066
Ragati	3	1.0	19	8	8	25,066	25,066
Rupingazi	3	1.0	13	5	5	17,605	17,605
Bwathunaro	3	0.8	19	6	8	18,652	24,869
Thuci	3	1.0	18	7	7	23,639	23,639
Thanantu	6	1.0	19	8	8	24,869	24,869
Muringato	2	1.0	14	6	6	18,835	18,835
Kathita tributaries	4	1.0	19	8	8	24,869	24,869
Kayahwe	4	1.4	17	10	7	31,152	22,251
Ruguti	5	4.0	18	29	7	94,555	23,639
Chania	2	0.8	14	5	6	14,953	18,691
Average for all river basin	**4**	**2.4**	17	17	7	33,314	22,011

Table 3.83: Beans Yields and Income Per River Basin

River Basin	Average Acreage	Beans	Yield (90Kg bags/ha)	Average output per river basin (90kg/acre)	Yield (90kg/acre)	Average income per river basin at price/Kshs 6133	Income Per Acre (Kshs)
Nairobi	4	0.2	7.9	1	3	3,923	19,616
Rwamuthambi	4	0.8	10.0	3	4	18,622	24,830
Mariara	2	0.4	7.5	1	3	7,449	18,622
Sabasaba	3	0.8	9.4	3	4	18,672	23,340
Amboni	18	1.3	7.9	4	3	24,520	19,616
Ura	4	1.0	7.5	3	3	18,622	18,622
Nyamindi	5	1.0	10.0	4	4	24,830	24,830
Thika	2	1.0	9.4	4	4	23,340	23,340
Maragwa	4	2.0	9.4	8	4	46,680	23,340
Thangatha	1	3.0	7.5	9	3	55,867	18,622
Thiba	5	3.6	10.0	15	4	89,388	24,830
Mathioya	3	0.9	9.4	3	4	21,006	23,340
Ena tributaries	2	2.1	7.1	6	3	37,021	17,629
Maara	6	1.4	7.2	4	3	25,029	17,878
Thingithu	4	2.0	7.5	6	3	37,245	18,622
Murubara	4	2.0	10.0	8	4	49,660	24,830
Ragati	3	0.4	10.0	2	4	9,932	24,830
Rupingazi	3	1.3	7.1	4	3	22,037	17,629
Ruji weru	3	0.4	7.5	1	3	7,449	18,622
Thuci	3	0.8	7.2	2	3	14,302	17,878
Thanantu	6	1.0	7.5	3	3	18,622	18,622
Muringato	2	0.8	7.9	2	3	14,712	19,616
Ngaciuma	4	1.0	7.5	3	3	18,622	18,622
Kayahwe	4	0.7	7.9	2	3	13,731	19,616
Ruguti	5	2.0	7.2	6	3	35,755	17,878
Chania	2	0.2	9.4	1	4	4,668	23,340
Average for all river basin	**4**	**1.2**	8.3	4	3	25,450	20,714

Source: Study findings 2014, www.kilimo.co.ke 2014

Table 3.84: Banana Yields and Income Per River Basin

River Basin	Average acreage	banana	yield per County /Ton/Ha	Average output per river basin (Ton/Acre)	Yield Tons Per Acre	Average income from Bananas per River Basin	Income per acre (Kshs)
Nairobi	4.4	0.04	9.2	0.1	3.7	3,468	86709.7
Rwamuthambi	3.9	0.5	38.7	7.8	15.7	181,827	363654.6
Mariara	1.9	0.4	50.6	8.2	20.5	190,141	475353.2
Sabasaba	2.5	1.8	19.7	14.4	8.0	333,123	185068.3
Amboni	18.3	0.3	9.3	1.1	3.7	26,069	86897.6
Ura	3.5	1	50.6	20.5	20.5	475,353	475353.2
Nyamindi	4.5	1	38.7	15.7	15.7	363,561	363560.6
Thika	1.8	0.75	19.7	6.0	8.0	138,801	185068.3
Maragwa	3.7	0.5	19.7	4.0	8.0	92,534	185068.3
Thangatha	1.43	0.6	50.6	12.3	20.5	285,212	475353.2
Thiba	5	0.3	38.7	4.7	15.7	109,068	363560.6
Mathioya	2.6	0.2	19.7	1.6	8.0	37,014	185068.3
Ena tributaries	2	0.6	0.8	0.2	0.3	4,329	7214.8
Maara	5.5	0.6	72.1	17.5	29.2	406,399	677331.3
Thingithu	4.3	0.7	50.6	14.3	20.5	332,484	474977.4
Murubara	4.2	0.9	38.7	14.1	15.7	327,205	363560.6
Ragati	2.6	0.3	38.7	4.7	15.7	109,068	363560.6
Rupingazi	2.8	0.3	0.8	0.1	0.3	2,142	7139.7
Bwathunaro	3	1	50.6	20.5	20.5	475,165	475165.3
Thuci	3	1.8	72.1	52.5	29.2	1,219,196	677331.3
Thanantu	6.4	4.3	50.6	88.1	20.5	2,044,019	475353.2
Muringato	2.3	0.5	9.3	1.9	3.7	43,449	86897.6
Kathita tributaries	4.1	0.75	50.6	15.4	20.5	356,515	475353.2
Kayahwe	3.6	0.4	9.3	1.5	3.7	34,759	86897.6
Ruguti	4.8	0.7	72.1	20.4	29.2	474,132	677331.3
Chania	1.6	0.4	19.7	3.2	8.0	74,065	185162.3
Average for all river basin	**4.0852**	**0.81**	34.7	11.4	14.0	313,042	325,538

Source: Study findings 2014

3.4.15 Fisheries

In Nyeri county, main fisheries activities in the county are pond fish farming, dam and river line fisheries. There are a total of 2,400 households involved in the subsector with 2,622 fishponds spread across the county. The main fish species include tilapia, catfish, and trout. The county has a mini processing plant in Wamagana in Tetu. There were also hatcheries in Sagana river and in Hombe forest.

In Embu County, the main types of fish in the county include; trout, tilapia, mud fish and cat fish which are available mostly in the hydroelectric dams although aquaculture is gaining momentum with farmers /groups. The county boosts over 200 fish ponds. In Tharaka Nithi County, fishing activities are concentrated mainly in Mutonga River and in the upper zones i.e. Chuka and the main type of fish produced are catfish, eel fish, trout and tilapia.Meru county also has a fish processing facility in Kanyakine, which has a capacity to handle tones per day. The County has over 2,000 fish pounds which are evenly distributed in all parts of the county. The county has highly benefited from the various Government programmes with every constituency having at least 200 fish ponds. The major types of fish are tilapia, mud fish and trout. Kirinyaga County has over 1,281 fish ponds spread throughout the county. Most of the public primary and secondary schools in the county have also embraced fish farming with the aim of enhancing their income. Fishing is also carried out at Tana River mostly in Sagana area. There are 200 fishermen who mostly sell the fish by the roadside and this makes it difficult to establish the amount of fish that is sold. The fishermen mostly use hooks while fishing and the main species of fish found in the river are mudfish, tilapia and catfish.

The main source of fingerlings is Sagana Fisheries Department, Kiganjo Trout Center, and Ebenezer Fish Farm in Sagana River Basin. The main fish stocks are trout and tilapia.

Table 3.85: Types of Soils and Activities Across the Counties

	COUNTY	MURANG'A	NYERI	KIRINYAGA	THARAKA NITHI	EMBU	MERU
a)	Main Economic Activities	Agriculture Cash crop farming Subsistence farming Livestock keeping Fish farming Horticultural crops	Agriculture Cash crop farming Tea, coffee Livestock farming Pyrethrum Horticultural crops	Agriculture Cash crops, tea, coffee, subsistence crops, livestock, bananas, beans, tomatoes, mangoes Rice production	Agriculture, cash crop farming in upper zones(Chuka) Livestock, apiary, cereals production	Agriculture Coffee, Tea Dairy, food crops Maize, beans, potatoes, Horticultural crops	Agriculture Farming Cash crops Tea, coffee Livestock keeping
b)	Main Land Use	Cash crops Subsistence crops Livestock keeping Bananas, fisheries	Cash crops tea, Coffee, livestock Substance Farming, livestock Fisheries	Cash crops Tea, coffee Livestock, fish production, Horticultural crops	Cash crops, food crops, livestock, horticulture	Cash crops (Coffee, tea) Food crops Livestock keeping Fish farming Horticultural crops	Food crops Cash crop Livestock
c)	Main Soil Types	Nitosols Ferralsos Luvisols Andosols	Vertisols Humic Anolosols Nitosols Luvisols/ Nitosols	Notosol Ferralsols Andosols Acrisols	Nitosol, clay loam, Luvisols, red clay, moderately fertile	Andosols Lithosols Vertisols Luvisols	Mollic Andosols Nitosols Humic cambisols Luvisols
d)	Main Soil and Water conservation hotspots Appropriate Remedies	Makuyu, Kambiti, Kakuzi, Ithanga, Maragwa Ridge, Githuuri Dig Fanya Juu Plant nappier row Terraces Ridges	Areas rather arid/ dry lower parts Eastern side Prepare Fanya Juu, mulching, plant nappier tour terraces, ridges	Lower eastern side Dig Fanya Juu Mulching, Plant nappier row Terraces, ridges	Kanduni Valley Terraces, Ridges, Dig Fanya Juu Mulching, nappier, contours	Lower eastern side Plant rows of nappier, dig Fanya juu, Terrace	Lower part of Meru – plant rows of nappier, Dig Fanya Juu, Terrace Dig Fanya Juu Mulching Plant nappier row Terraces, ridges
e)	Soil conservation measure used by farmers	Terraces, ridges Maize stover Mulch, Fanya Juu	Terraces, sloves mulch, nappier rows a, ridges, stone line		Nappier grass, tree planting, terraces, and planting along contours		Terracing Fanya Juu 60%

	Water conservation measures used by farmers	Cut of drain Ridges, Terraces Plant row nappier	Cut of drain ridges, terraces, rows of nappier	Cut of drain Ridges, Terraces Sand Dams	Cut of drain Ridges, and Terraces, nappier and contour	Cut of drain Ridges, Terraces Sand Dams	Cut of drain Ridges, Terraces Sand Dams
f)	Percent of farmers using improved seeds of major crops	About 80%	About 65%	About 45%	About 64.%	About 40%	About 55%
g)	% of farmers using various technologies - Crops - Livestock - Apiculture - Fishing - Aquaculture - Proportion	65% using variety of technologies 65% 27% 90% 15% 16%	About 63% using technologies 63% 35% 80% 18% 10%	About 45% 45% 32% 40% 12% 12%	About 54% 23% 34% 5%	About 40% 41% 45% 46% 15% 20%	About 52% using Technology 52% 55% 60% 45% 35%
h)	Major cropping activities Types of crops grown production, distribution challenges faced increasing production.	Coffee, Tea Food crops, Maize Beans, bananas Cabbages, mangoes Production medium yield, poor roads poor infrastructure input availability cost, poor markets	Coffee, tea, pyrethrum, maize, beans, bananas, cabbages, horticultural crops Poor infrastructure Input supply Poor markets	Coffee, tea, food crops, bananas, tomatoes, mangoes Poor infrastructure Lack of input supply, poor markets	Coffee, tea, food crops, beans, maize, bananas, medium yields Poor roads, high costs of inputs, poor markets	Coffee, tea, food crops, bananas, cabbages, tomatoes, beans, mangoes, avocado, and watermelon. Poor infrastructure Lack of input supply, poor market	Coffee, tea, bananas, maize, beans, tomatoes Poor infrastructure lack of input supply Poor markets
i)	Number of farmer, ha under Horticultural farming productivity level.	10% Not available	10% Not available	8% Not available	32%	8% Not available	2131 ha under horticultural crops
j)	Main livestock production practices by prefilling livestock types	Ranches 1, cattle, pigs, goats, sheep, rabbits, donkeys, chicken, cocks, gees, turkey	Cattle pigs, sheep, rabbits, chicken, goats (Dairy)	Dairy Cattle Zebu 69.183 29.716 Beef cattle 11,068 Goats, dairy 48,960	Dairy cattle (Fresian, Ayrshire dairy goats, piggeries, improved chicken	Cattle (Dairy) Zebu, beef cattle, goat dairy, indigenous goats, sheep.	Friesian, Zebu, Jersey, Sheep (Merino) Dairy Goats (Toggenburg)

	Distribution, production	Dairy cattle, tea and coffee zones, sheep, rabbit lower zones	Dairy cattle, Tea, Coffee zones, sheep, goats lower, rabbit& pig zone	Indigenous 13,940 Sheep hair 10 Dairy cattle, tea, coffee zones, lower zones for goat.		Dairy cattle, upper zone, lower zone Goats, sheep, pigs	Upper zones for Dairy cattle lower zones for goats, sheep.
k)	Inventorize marketing Channels and facilities Used by producers and traders in marketing produce products recommend ways of improve marketing.	The marketing channels not well organized. Marketing infrastructure needs coordination farmers should be organized to form groups	Marking is dominated by middleman Marketing need coordination farmer should from groups to get high return for their produce	Poor marketing system Farmers should form groups and marketing be coordinated for farmers to benefit	Not well organized, farmers groups, brokers, Farmers should form and/or strengthen marketing groups	Marketed not coordinated farmers should form groups to benefit from their produce market to be re-organized.	Poor marketing system, homers should for groups and market produce together road to the market should be upgraded and maintained.
l)	% of farmers who - belong to primary producer - Secondary marketers - Tertiary marketers	Only horticultural farmer who belong to primary producer groups of about 10%	Only horticultural farmer who belong to primary producer groups of about 10%	Horticultural farmers 10% belong to primary	14% belong to primary	Horticultural producer 8% primary	Horticultural produce of Bananas 10% primary.
m)	Inventorize main sources of credit financial institution, lending conditions % of farmers with access.	Commercial Bank Micro-finance Insurance companies SACCOs Meet monthly payments	Commercial Bank micro- finance SACCOs Meet monthly payments	Commercial Bank micro- finance SACCOs Meet monthly payments	Commercial banks, SACCOs, micro finances,	Commercial Bank micro- finance SACCOs Meet monthly payments	Commercial Bank micro- finance SACCOs Meet monthly payments
n)	Type of Agri- based processing facilities - Value addition - Cottage	Macadamia nuts, passion fruit Milk processing	Macadamia nuts, passion fruit Milk processing	Rice Processing at Mwea Milk processing	No agro processing facility	Macadamia nuts, passion fruit Milk processing	Milk processing Banana processing

	industries and potential						
o)	Means of livelihood - Crops grown for cash - Horticultural, - Livestock types/ numbers - Bee keeping status	Food crops Maize, beans Cabbage, potatoes, bananas, dairy cattle, chicken apiaries , hives 4,103	Food crops potatoes, beans, bananas, dairy cattle, chicken	Food crops, potatoes, beans, bananas, dairy cattle, chicken, farmer 865 18,199 hives	Crops grown for cash, maize, beans, bananas, dairy cattle, goats and chicken	Food crops, potatoes, beans, bananas, dairy cattle, chicken	Food crops, potatoes, bananas, dairy cattle, chicken
p)	Average proportion of farm under crops and maize per (ha)	80% is (under crops)	90%	86%	49%	85%	80%
2)	Established fish processing Hatcheries Milk production litres Value Kshs Beef production Value KShs Mutton production Value KShs Eggs production trays Values KShs Poultry meat kgs Value KShs Honey production Value KShs Pork production kgs Value KShs	0 0 106,220,472 2,422,702,695 2,053,361 461,678,370 2,186,667 750,985,365 4,102,948 68,123,022 292,596 75,597,440 66,225 18,591,080 664,367 124,463,540	0 0	0 0 63,611,821 1,447,519,167 1,259,760 314,940,000 32,813 11,484,550 23,606,317 188,850,536 398,860 127,635,200 86,489 43,244,500 71,220 17,805,000	 1,300,000 32,500,000 3,532,500 88,312,500 1,978,200 316, 512,000 50,400 5,040,000 314,666 75,519,840 1,071,900 192, 942, 000 11,000 60,000,000	0 0 25,280,000 50,560,000 6,000 792,000 3,306 595,080 39,794 11,938,000 65,000 12,650,000 82,500 8,250,000 37,380 6,336,400	0 0
	Fish catch(harvested) kgs Value Kshs	32,200 9,660,000		427,000 115,290,000		700 46,000	15,000 3,450,000

	Fishery production Fish farms Fish ponds Area of fish ponds (m^2)	2,330 2,520 714,000		 1,281 384,300		48 73 884.5	2,500 2,000 18,935
	No. cooperative societies active cooperatives Dormant Collapsed Total registered membership Total turnover Kshs	155 120 35 17 332,421 599,053,665		86 73 - 13 243,240 1,394,305,900		 49 24 - 168,428 625,954	Coffee 105,446 Estate 1,042 Housing 21,192 Sacco 103,982 Dairy 1,461 Multi Purpose 5,323 Irrigation 4,773 Union 21

3.4.16 Challenges and Recommendations in Agriculture Sector / Rural Livelihoods

i. Land degradation is a major challenge in the upper areas such as Kambiti, Makuyu Maragua, Akachio and Nkiene Hills mostly because of floods and the taking up of hill areas for farming and residence.
ii. The impacts of climate change are also a challenge. The rain patterns are changing with rain coming late and poorly distributed and there is also extreme heat (high temperatures) with high humidity mostly in the lower areas of the region
iii. It is also recommended to reclaim all the riparian areas and plant indigenous trees to protect further soil erosion. There is need also to train farmers on different effective farming methods and are encouraged to plant different crops to help deal with the soil erosion. There is also need to train farmers on contour farming and terracing of farm lands to cub soil erosion. Other measures include tree planting in hilly places and river banks.

Recommendations

i. Mitigation efforts include the adoption of drought tolerant crops hence less vulnerability to the impacts of climate change. In addition to that, there is tree planting as both soil conservation method, moisture retention and for improving tree cover
ii. Promote new agriculture technologies for farmers to adopt for increased productivity

Marketing Challenges

i. Lack of organized group marketing of farm produce
ii. Poor infrastructure especially road network which leads to high cost transportation of farm produce .
iii. Lack of accessibility to market information.
iv. Poor storage facilities which leads to perishability of farm produce.

Recommendations

i. Train farmers on group marketing and marketing strategies .
ii. Availing market information through notice boards and regular trainings for farmers.
iii. Regular maintenance of feeder roads in the region.
iv. Construction of grading and marketing sheds.
v. Improved storage facilities for preservation of perishable farm produce.

Challenges of livestock farming

i. The farm size in most households is small and hence there is inadequate fodder for feeding livestock. Most farmers opt for zero –grazing and “use cut and carry fodder method.” This also forces the farmers to focus on Zero-grazing
ii. Presence of tsetse flies that cause and transmit the deadly Trypanosomiasis (nagana) disease to the livestock.

iii. Lack of trained farmers(Inadequate knowledge on improved animal husbandry)
iv. Expensive feeds for livestock
v. Challenge of getting loans –Lack of affordable credit due to lack of collateral/security

What is being done about the challenges?

i. Training of farmers in the lower side of River Ura to plant fodder and conservation of harvest and farm by-products.
ii. Equity availing loans without collateral upfront
iii. Saccos such as Nyambene Sacco providing feeds which are then paid at the end of the month and providing a platform for group marketing of dairy products.

Recommendations of what can be done

i. Provision of loans with affordable interest or customized interest rates especially group guarantee schemes with little or no interest for farmers.
ii. Full disclosure of terms for loans since some credit institutions to avoid default which leads to auctioning of farmers assets so as to avert repossessing assets of farmers.
iii. Promoting group lending which has the following advantages due owing to the following advantages:
    - Enforcement repayment: Administration of loans is the responsibility of the client groups
    - Incentives to repay: social pressure at group meetings for those who lag behind in loan repayment
    - Screening of potential borrowers: individual members effectively screen each other through self-selection
    - Transparency: openness and accountability in the process of taking and repayment loans at group meetings
    - Targeting: regular compulsory group meetings may serve to discourage better-off people or well-to-do from taking part, hence increasing funds available for the low income people
    - Scale: reaches many people especially women – gender
    - Sustainability: program can achieve sustainability within 2-3 months
    - It is cost-effective as the responsibility is with the group
    - Regular savings enhances liquidity of organizations

3.5COMMUNITY EMPOWERMENT AND PARTICIPATION

3.5.1 Introduction

Experiences from past programmes and projects funded by development partners and the government shows that a focus on sustainability is key to the success of development initiatives in agriculture and NRM, and this is even more the case in a context of growing scarcities and climate change. Critical for sustainability is, in turn, fostering the capacity of poor rural people and their organisations to pursue viable livelihoods and to shape the circumstances that affect them (IFAD, 2001; 2007). Equally critical is developing better institutions and policies shaping poor rural people's environments and their interaction with others (IFAD, 2008b). Both capacity building and institutional and policy development are essential also in the process of scaling up successful initiatives.

However, production and access to knowledge and technology are areas in which existing power relations often marginalise poor rural people. Most research and technology development in NRM and agriculture aim to serve better-off or large-scale farmers and livestock producers, and smallholder-led technology and knowledge production remains insufficiently recognised and supported in formal Research and Development (R&D).

3.5.2 Financial Management Issues among the Target Communities

Most of the communities lack skills in financial management which may hinder their capacity to manage various projects. Record keeping is at very basic levels and lack the requisite documents such as receipt books, rubber stamps, invoice books as well as the necessary accounting systems to enable them know whether they are making any profits or not.

It was noted that mostly community groups only had treasurers who were mainly women because it is generally believed that women may not squander group funds. Some of the group officials were illiterate and therefore not in a position to understand various accounting requirements.

Literacy levels are very low as confirmed by household data with overall average of 29.75%, 38.30% and 21.15% for primary, secondary and post-secondary education respectively across all project areas. With these low literacy levels, financial management will remain a challenge for the communities. The project therefore will need to design a simple accounting system and train the communities on its use. Communities need to be capacity built on records and book keeping to ensure they are able to keep basic records.

3.5.3 Current Community Procurement Methods and Major Procurement Issues

Communities mainly use cash terms when procuring goods and services. The procurement process begins with group members deciding that they need a certain good or service. Usually two or three people mainly executive committee members are assigned the duty to do window shopping and report back to members on the lowest possible supplier in terms of price. They are then mandated to go ahead and procure. Quality issues are not put into consideration and at times issues arise as to the quality of goods or services procured which in some instances result in group conflicts. Very few community groups have procurement committees and tendering for goods and services is basically non-existent.

In order to address procurement issues, a lot of capacity building will be necessary. This can involve simplifying the public procurement and disposals act to fit the circumstances of small community based organizations. Community organizations should be assisted to set up procurement committees which can be mandated with tendering and evaluation of tenders for goods and services exceeding a certain threshold in value. Communities need to be capacity built on records and book keeping to ensure they are able to keep basic records and also be able to fulfill procurement requirements especially when using grant funds or when supplying goods and services to the project.

3.5.4 Community Participation in Rural Projects

Most community members have had a lot of exposure in managing donor funded projects. They have been exposed to basic planning and project implementation though more still remains to be done to empower them especially on self-monitoring and evaluation as well as report writing.

Mostly community members are consulted on what needs to be done but the ultimate decisions on what projects to implement is the preserve of the technocrats. Active participation would call for a situation where community members give their priorities out of which a panel examines and advices the communities on the best options.

Project sustainability will remain a challenge given that mostly many projects are donor driven and hence the efforts to maintain them fizzle out with the end of donor funding. In order to ensure sustainability, it is advisable to ensure beneficiaries contribute in cash to projects especially those which are income generating in nature. Where possible funding should be given as interest free loans which can be formed as revolving funds for purposes of benefiting more community members. This will also aid in ownership and minimize dependency system and handout mentality while instilling seriousness in project management since community members will be put on their toes to ensure they repay the grants.

To avoid group disintegration, the project should endeavor to work with existing (organically formed) groups and avoid as much as possible makeshift groups which are formed with the aim of accessing donor funds. Capacity building on group leadership and dynamics as well as project management will be critical for sustainability.

Proper beneficiary selection/ vetting criteria needs to be put in place to ensure the right beneficiaries are targeted. This should involve use of local leaders and other grassroots development actors to provide information about prospective beneficiaries. Interested communities should be made to send an expression of interest as a commitment after which they should enter into memorandum of understanding or contracts spelling out their roles.

3.5.5 Players in NRM in the Project Area

There are several players on NRM in the project area. These include schools both primary and secondary who can participate through environmental clubs in activities both within school compounds and outside. These can participate through environmental clubs which can take part in activities such as tree seedling production; tree planting; setting up of nature based enterprises such bee keeping, fish farming etc. both in their school compounds and in the neighboring forests and other public land. Schools can also participate in environmental awareness creation through drama and music etc. For example in Meru County alone, as of 2013, there were 712 primary schools and 112 secondary schools the County.

There are also higher learning institutions like colleges and universities which can play a big role in environmental conservation through tree planting, environment-related research as well as awareness creation through drama and music. For instance some of the private and public colleges in Meru include Meru Teachers College, Meru Teachers Training College, Kiirua Technical Training Institute, Egoji Teachers College, Meru Technical Training Institute and Nkabune Technical Training Institute among others. The county also has a number of universities that include Meru University College of Science and Technology, Mt. Kenya University; Nkubu and Kenya Methodist University (KEMU).

Murang’a County hosts several colleges among them Murang'a Teacher's College, Murang'a Technical Institute and Kenya Medical Training College (KMTC) - Murang'a, Michuki Technical Training Institute, Murang'a College of Technology and Mbiiri Institute of Professional Studies. See the table below for statistics on number of primary and secondary schools in various counties in the project areas.

The areas have several tea and coffee factories whose role in environment management is crucial given that they emit a lot of effluents to the environment. In particular tea factories are also large consumers of wood energy and therefore they can participate in tree planting by producing seedlings and establishing their own woodlots while at the same time encouraging their members to plant trees in their tea estates. Non-

GovernmentalOrganizations (NGO) like Green Belthave played and continues to play a key role in environmental conservation. The project should partner with them to enable synergies and avoid duplication of efforts.

Table 3.86: Primary and Secondary Schools in Various Counties

County	Primary schools	Secondary schools
Muranga	739	271
Meru	712	112
Nyeri	584	194
Embu	450	145

3.6 Project Management and Coordination

3.6.1 Project Implementation Structures

The survey established that the project is being implemented through existing government institutions according to their mandates. The also survey established that most structures envisaged in the design like the Project Steering Committee, Project Coordination Team, were already in place and working, while others like the County Project Coordinating Committee and County Project Facilitation Teams were being put in place.

3.6.1.1 Introduction

For effectiveness and efficiency in management of project activities to ensure the goal and objective are achieved, the survey established that the project has several management structures each with specific roles to play. These are:

3.6.1.2 Project Steering Committee (PSC)

This is a committee established at the national level and draws its membership from major stakeholders bearing direct relevance to the project scope. These include the representatives of the principal secretaries and Chief executive Officers of the implementing ministries/agencies, community representative and the private sector. The role of the PSC is to provide policy guidance to the project. Specifically, the PSC is responsible for:

i. Reviewing project progress against targets,
ii. Assessing management effectiveness of the project,
iii. Deciding on corrective measures to the project where appropriate,
iv. Reviewing lessons learned and good practices,
v. Ensuring that the Project activities are in compliance with the Government's policies;
vi. Ensuring that the project Annual Work Plan and Budget (AWPB) is in line with GOK

and IFAD requirements and approving the respective AWPB.

The relevance of the PSC is manifested in its role of providing policy guidelines to the project to ensure that the project interventions are in line with long term goals of the Government and IFAD and that specific sector priorities are addressed.

3.6.1.3 Project Coordinating Team (PCT)

This is the management structure responsible for project management and coordination on a daily basis. It is made up of different Technical Officers headed by the Project Coordinator. Specifically, the PCT is responsible for:

i. Planning of project activities through preparation of AWPBs
ii. Coordinating implementation of project activities according to approved AWPB
iii. Financial and administrative management of the project resources
iv. Supervision, M&E and documentation of all activities
v. Preparation of project progress reports.

3.6.1.4 County Project Coordinating Committee (CPCC)

Each of the six (6) project Counties has a County Project Coordination Committee (CPCC) which coordinates and provides leadership to project implementation at the county level. During the design of the project, the CPCC was envisaged to be chaired by the county government but as a result of the new changes in the structure of devolution, this study proposes that CPCC be chaired by the county Commissioner. The study also proposes that the membership of CPCC be: County Commissioner (Chair), County Chief Officers responsible for Water, Environment, Agriculture and Livestock, Fisheries, Social Services, Planning and Cooperatives, County Project Coordinator (CPC), WRUA and CFA Representative.

The roles of the CPCC are:

i. Ensuring integration and harmonization of project activities with the County Integrated Development Plans and other development initiatives in the county;
ii. Providing guidance and overseeing the implementation of all project activities in the county.
iii. Reviewing and approving consolidated County project AWPBs; and
iv. Receiving and reviewing all progress monitoring and impact evaluation reports submitted by Implementing Agencies and the County Project Facilitation Team.

The role of the CPCC is very relevant in ensuring that the county specific project interventions are in line with county development objectives and specific sector priorities.

3.6.1.5 County Project Facilitation Team (CPFT)

The survey established that at the county level there is another structure, the CPFT which is the technical body in project implementation at the county and made up of the directors of the implementing ministries and agencies. The committee is chaired by the County Project Coordinator who also provides the link between the CPFT and CPCC.

The roles of the CPFT include:

- Coordinating the preparation of county AWPBs in line with the sectoral priorities in the respective counties;
- Coordinating and participating in the development of Community Action Plans (CAPs) to ensure participatory identification of projects to be financed under UTaNRMP.
- Carrying out Monitoring and Evaluation (M&E) of project activities in the county and
- Providing oversight in implementation of community grants
  In order to ensure effective M&E of project activities at county level, the survey recommends establishment of an M&E subcommittee headed by the Director of Planning to spearhead M&E function of the project activities at the county level. This subcommittee will be responsible for consolidation of county AWPBs, M&E backstopping to the communities implementing grants and progress reporting.

3.6.1.6 Sub County Implementation Structures

The survey established that there is a gap in terms of implementation teams at the sub county and ward level. After the CPFT at the county level, the next structure is WRUA/ CFA which are at the river basins level. There is therefore a need for the project to introduce a project management structure at the sub county levels so as to effectively coordinate project implementation at that level.

The Sub county Implementation Team/ Committee should be chaired by the sub County Commissioners and composed of other sub county implementing departments .i.e. Water, Agriculture, Livestock, Veterinary, Fisheries, Cooperatives, Social services, Planning, Environment, Kenya Wild Life Services and Kenya Forest Services.

These teams will be responsible for:

i. project implementation in sub counties
ii. Technical backstopping in community grants.
iii. Preparation of sub county AWPBs
iv. Coordinating and facilitating the development of Community Action Plans (CAPs) in respective river basins

v. Carry out M&E of project activities in the county and progress reporting.

The survey further established that the project was in the process of delineating Focal Development Areas (FDA) in river basins and formation of Focal Development Area Committees (FDACs) which will oversee the implementation of project activities at FDA level. There are also existing WRUAs and which the project is facilitating to form and build capacity in addition to the Community Forest associations. These structures are very critical for successful project implementation since they are composed of the communities who will participate in administration of grants.

3.6.1.7 WRUAs/CFAs

These are established by specific legislations (Water Act 2002 for WRUAs). They will be responsible for:

i) Overseeing project implementation through grants by Common Interest Groups (CIGs) within their respective areas including M&E.
ii) Endorsing CIGs' proposals falling within them for funding
iii) Implementing community projects that are of public good in nature through WSTF funding window.

3.6.1.8 Focal Development Area Committee (FDAC)

They will be elected community members in the FDA. They will play a crucial role in preparation and implementation of Community Action Plans as well as monitoring, supervision and reporting of community projects funded through grants.

3.6.2Financial Management

3.6.2.1 Financial Management

The survey established that the project has adopted both IFAD and GoK Financial Management systems and procedures, which is also in line with the International Public Sector Accounting Standards. At the counties, project funds are captured in the normal GoK vote books and cash books. The project obtains expenditure reports from all implementing agencies and cost centres in order to update the project financial statements.

The project is in the process of designing Financial Management System software which will ensure efficiency in the project financial management. Once installed, the system will assist the project in budgeting, disbursements, tracking expenditures and procurement.

The survey established that the project is being audited by Kenya National Audit Office (KENAO) and the audited financial statements submitted to IFAD by 31st December every year together with the management letter.

At the county levels, the project has appointed County Project Coordinators as the Authority to Incur Expenditures (AIE) holders in their respective counties. The project funds at the counties are processed at the respective National Treasuries (at each County Head Office). Each county has opened designated project accounts where project funds are disbursed to and spend from. The study established that all project activities in each county are expected to be funded from the project accounts held at the county head office level. This may pose a challenge to government staff coordinating activities at the FDAs located far away from the county office since they have to travel long distance to be facilitated to undertake their activities.

At the counties, project funds are captured in the manual vote books and manual cash books. The project obtains expenditure reports from all implementing agencies and cost centres in order to update the project financial statements.

3.6.2.2 Flow of Funds

According to the project documents guiding financial management, the Project funds (GoK/IFAD) can only be accessed using GoK systems under either revenue items (includes Advance and Reimbursement procedures) or the Appropriation In Aid (AIA) disbursement System (includes Direct Payment and Commitment procedures). PCT initiates the disbursement process by preparing WA and/or Special Exchequer Requisition (SER) which is submitted to Project Lead Agency for review and forwarding to National Treasury (if concurred) for further processing. National Treasury reviews authorize and submit WA to IFAD KCO. IFAD reviews, approve and disburse funds from loan account(s) to designated account(s) held with National Treasury for the Project (for revenue) or pays directly to the contractor/supplier (if AIA).

National Treasury then facilitates the release of revenue funds to Project Lead Agency for onward transfer to the PCT account(s). PCT then spends and or further disburses part of the received funds to other agencies (Counties, WSTF, KARI etc.), account for the spent funds and seek for replenishment through the same process.

Considering the lengthy funds flow process, it is necessary for the project to ensure minimal delays in the disbursement cycle by ensuring that the requisitions are done on time and all the required documentations is provided.

The study also established that the project is using the following disbursement procedures:

i. **Advance withdrawal/Initial Deposit:** provides a mechanism to assist the GoK in financing eligible expenditures defined in the Loan Agreement as payment falls due. IFAD has advanced $1.2 million and 800,000 Euros as initial deposit to designated project account.
ii. **Direct Payment:** Under this procedure, the GoK requests IFAD to pay suppliers/consultants directly from the Loan Account. This method is suitable for payment of: i) Large civil works, ii) Retention money, iii) Consultant fees, iv) Importation of goods (excluding a letter of credit arrangement) and v) When there are liquidity challenges experienced by project.
iii. **Special Commitment (under letter of credit):** This procedure is used for financing imported goods required by the project under a letter of credit arrangement. IFAD makes a commitment and agrees to pay the negotiating bank (on behalf of the borrower from the loan account) for payments to be made to the supplier, under and in accordance with the terms of a specific letter of credit.
iv. **Reimbursement Method:** This method is followed when expenditures have already been incurred, that is, the supplier of goods, works, consulting or other services has already been paid by the borrower from its own funds. This method is generally suitable for payment of local currency expenditures, petty cash or small purchases, small civil works payments, and the Borrower/PLA's provision of financial resources to the Project to help manage negative liquidity effects.

3.6.3Procurement Management

Prudent procurement management positively impacts on achievement of project goals and objectives. The study established that Procurement of goods and services by the project takes place at various levels .i.e. PCT level, County level and at the community level.

The study established that project procurement procedures are being guided by the Public Procurement and Disposal Act (2005), its regulations 2006 and IFAD procurement procedures/ guidelines. The project has developed guidelines to guide procurement by community members who will be managing grants by the project.

The survey established that the project procurement unit was inadequately staffed as provided for in section 26 (c) of the Public Procurement and Disposal Act 2005 which provides that all procurements shall be handled by different offices in respect of procurement initiation, processing, receiving and issuing of goods works and services. The project procurement unit has only two (2) officers; the Procurement Officer assisted by an Assistant Procurement Officer.

3.6.3.1 Procurement Methods

The study further established that the project is using different methods of procurement as provided for by the Procurement and Disposal Act (2005), its regulations 2006 and IFAD procurement guidelines. These are:

a) **International Competitive Bidding (ICB):** Involves advertising tenders internationally and is being used to procure large quantities of items including equipment, vehicles and office equipment
b) **National Competitive Bidding (NCB):** Involves advertising tenders within the Kenya boundaries and is being used to procure goods and services. With NCB, the publication of the invitations is limited to national publications.
c) **Shopping/Request for Quotation:** this method is used to procure goods, works or services which are readily available and which are within the set financial ceiling for RFQs. It involves obtaining quotations from at least 3 different reputable suppliers.
d) **Direct Procurement:**This method of procurement is used when the procuring unit/community procurement committee would use one provider/supplier under exceptional circumstances that do not require competitive procurement. These conditions include:
   i) When extending existing contracts for standardization and repair of equipment. This extension has to be approved by the contracts committee;
   ii) In cases where compatibility with existing works is required;
   iii) When there is need for continuity in works already on-going;
   iv) Where: there is insufficient time for any other procedure such as the case of emergencies, as epidemics, break up of war, floods and others and where following the appropriate procedures may lead to delays thereby compromise the quality of people's lives;
   v) When the works supplies or services are available only from a single provider.

3.6.3.2 Procurement Planning

The study established that during the preparation of AWPBs, the PCT prepares a Consolidated Annual Procurement Plan based on the annual work plans and budget and submit the same to IFAD for approval. The approved plan is implemented by the various implementing agencies, which submits quarterly financial monitoring reports to IFAD on the progress of implementation. The Procurement Plan may be updated quarterly if required, to reflect the actual implementation activities of project.

3.6.4 Planning, Monitoring and Evaluation

3.6.4.1 Planning

From the study findings, the project employs a bottom up participatory planning approach which involves beneficiary communities in identifying their felt needs to be implemented by the project.The project has supported the development and review of SCMPs by the WRUAs that don't have. The project also supports preparation of Community Action Plans through PRA process, participatory forest management plans. The CAPs, SCMPs and PFMPs reflect the community felt needs and forms the basis for preparation of county and project AWPBs. All these plans are in line with specific County Integrated Development Plans.The CAPs also serve as a targeting tool to engage the poor and vulnerable, for gender mainstreaming, and assist in livelihood and poverty analysis.

The preparation of county AWPB and project AWPB follows the Government budgeting cycle which starts by the issuance of the budget circular by the Cabinet Secretary for National Treasury. The County AWPBs are consolidated at the PCT to form the project AWPB which must be approved by PSC and IFAD before it is incorporated in the PLA's annual budget.

This is an effective and participatory approach to planning which ensures inclusivity and ownership by all project stakeholders.

3.6.4.2 Monitoring and Evaluation

Monitoring is the systematic collection and analysis of information as project implementation progresses. It is aimed at improving the efficiency and effectiveness of a project and is based on set targets and activities planned during the planning phases of work.

Monitoring helps to keep the work on track, and can let management know when things are going wrong. If done properly, it is an invaluable tool for good management, and it provides a useful base for evaluation.

Evaluation is a periodic exercise that compares the actual project impacts against the agreed strategic plans. Evaluation looks at what was set out to be done, what has been accomplished, how it was accomplished.

The study established that the project was in the process of developing Monitoring, Evaluation, Learning and Reporting system which will help the project to effectively measure, use and share results from all project activities to help in decision making, learning, and accountability and meet the information needs of different stakeholders and

enable the project staff to report on impacts of the project interventions. The system is intended to facilitate the collection and collation of data, reporting the progress of project implementation and achievements of results in a real time manner to support evidence based decision making and management.

The system will have key focal persons, at the PCT and counties, who will be responsible for capturing project implementation in real time basis. With successful implementation of the system, the project will be able ensure timely reporting of the implementation progress. The study however noted that the knowledge of M&E is still low at the counties and other devolved units.

The project has established various implementation structures .i.e. PSC, PCT, CPCC, CPFT, WRUAs/CFAs, FDACs and CIGs each of which has a monitoring and evaluation function. These structures will ensure smooth project implementation at all levels. The project further is in process of forming monitoring teams at the county and sub counties to provide guidance in monitoring and evaluation.

The study further established that the project has developed reporting formats to be used by CIGs, FDACs, WRUAs/CFAs, CPFTs, CPCC and PCT. This will ensure ease in reporting project implementation status. Further the project is using standardized formats for AWPBs and annual reports. The reporting frequencies at each level are clear. Some of the methods the project is intending to use to carry out M&E function are: periodic reports, periodic meetings, field visits to provide technical support, Annual Review meetings, IFAD/GOK implementation support missions, periodic surveys, case studies, capturing innovations and lessons learnt.

3.6.5 Knowledge Management and Learning

The main purpose of the project Knowledge Management and Learning process is to ensure that knowledge generated within the project is systematically identified, analysed, documented and shared. The knowledge generated will be used to support capacity building and institutional strengthening of stakeholders including community organisations, service providers, farmer organisations and government departments

The study established that the project is in the process of developing communication strategy for the project. The study further noted that the project Knowledge Management and Learning aspects involves: M&E, Information Management, Communication and feedback, Innovation and experimentation and continuous Learning and adaptation.

Some of the Knowledge Management and Learning activities being implemented by the project are: continuous technical training and capacity building, exchange/study tours, on-farm adaptive trials and demonstration and support for farmer-to-farmer learning,

KM processes will ensure that appropriate lessons learned and good practices from other parts of the region and the world are gathered and disseminated within the project area.

3.6.6 Recommendations

The project design was carried out before the implementation of the new constitution which has given rise to new structures which are still in their early stages. As such, there are lots of challenges on the roles and functions of national and county government and how they inter-relate. The UTaNRMP must thus carefully engage with both the national and county government, maximizing on synergies at each level in order to ensure successful implementation of planned project. Project staff must also try not to be sucked in on power plays between the national and county government.

A lot of awareness creation must also be undertaken to ensure that people understand how the project has been planned, and how it will work with both national and county governments in implementing its mandate.

Additionally, in funding projects within the Focal Development Areas and those under WRUAs and CFAs under the WSTF, conscious attention must be given to have some form of equity among counties and sub-counties, while at the same time promoting healthy competition among them. Areas which have traditionally been left behind development-wise like Tharaka Nithi County may also be given preference.

The study recommends that the project should consider opening project accounts at the sub counties to minimize risks in handling project funds and save on time wasted traveling to and from county headquarters.

The survey established that with only two (2) officers, the procuring unit is understaffed and there is need to add an officer in the unit to handle various aspects in the procurement such as procurement processing, receiving and issuing of goods works and services as provided for by section 26 of the Public Procurement and Disposal Act 2005.

There is need for the project to carry out basic trainings on M&E to project officers and communities so as to ensure quality reporting and capturing of impacts. The study further recommends that the project should expedite the process of developing and installing the Financial Management Software.

4.0 REFERENCES

1. Aberdare Forest Reserve Management Plan; KFS: 2010-2019
2. Accelerated Agricultural Inputs Access Programme (NAAIAP) in Collaboration with Kenya Agricultural Research Institute (KARI) Department of Kenya Soil Survey: 2014
3. Ashington Ngigi, EAC Strategy to Scale-Up Access to Modern Energy Services; Kenya *Country* Baseline *Report* andWorkplan: 2008
4. Commission on Revenue Allocation–CRA (2011), Kenya County Fact Sheets 2011. Nairobi: Commission on Revenue Allocation.
5. Community Forest Association: Land Development and Governance Institute:2012
6. Conservation in Kenya; Lessons from The Case of Mwaluganje Elephant Sanctuary and Hombe Forest Station.
7. District Environmental Action Plan; Murang'a District: 2006 – 2011
8. East African Community (EAC); Strategy on Scaling Up Access to Modern Energy Services
9. Francis Koome Simon. Influence of Community Capacity Building on Performance of Water. 2013.
10. Gikonyo, J.M & Kiura C. Strategic Environment Assessment for Upper Tana Natural Resource Management Project; IFAD, 2011
11. Government of Kenya (2010), *2009 Household and Population Census*, Nairobi: Government Printer.
12. Government of Kenya, County Government of Embu, County Integrated Development Plan: 2013-2018
13. Government of Kenya, County Government of Kiambu, County Integrated Development Plan: 2013-2017
14. Government of Kenya, County Government of Kirinyaga, First County Integrated Development Plan (Draft): 2013-2017
15. Government of Kenya, County Government of Meru, County Integrated Development Plan: 2013-2017
16. Government of Kenya, County Government of Muranga, County Integrated Development Plan: 2013-2017
17. Government of Kenya, County Government of Nyeri, County Integrated Development Plan: 2013-2017
18. Government of Kenya, County Government of Tharaka Nithi, County Integrated Development Plan: 2013-2017
19. Government of Kenya, County Government of Tharaka Nithi, Tharaka Nithi County Strategic Plan: 2012-2017
20. Government of Kenya, Early Warning System,Tharaka Nithi. National Drought Management Authority Tharaka Nithi County EWS Drought Monitoring Bulletin June 2013

21. Government of Kenya, Economic Review of Agriculture 2013, Central Planning and Project Monitoring Unit, Ministry of Agriculture
22. Government of Kenya,Ministry of Environment and Mineral ResourcesNational Environment. KenyaNational Environment Action Plan: 2009 – 2013.
23. Government of Kenya, National Environment Report 2013
24. Government of Kenya, Soil Fertility Report 2014,
25. IGAD Center for Pastoral Areas and Livestock Development (ICPALD), Policy Brief Series: 2013
26. Kenya Institute for Public Policy, Research and Analysis, Kenya Economic Report: *Creating an Enabling Environment for Stimulating Investment for Competitive and Sustainable Counties: 2013*
27. Kenya National Bureau of Statistics (Various), *Economic Survey*. Nairobi: Government Printer.
28. KIPPRA (2013), *Kenya Economic Report 2013*. Nairobi: Kenya Institute for Public Policy Research and Analysis.
29. Mt. Kenya Forest Reserve Management Plan; KFS: 2010-2019
30. Mutero Paul Kaniaru; The Effect of Tea Growing on Forest Degradation in Chinga Area of the Aberdare Ranges in Nyeri County, Kenya.A Research Project in Environmental Planning and Management, For the award of a Master of Arts Degree in Environmental Planning and Management in the Department of Geography and Environmental Studies, University of Nairobi: 2013
31. Paul Guthiga and Maurice Ogada,A Research Report prepared for the Land Development and Governance Institute (LDGI): Harnessing Proposed Land Reforms to Promote Environmental
32. Policy Briefs No. ICAPLAD 4/8/2013, The Contribution of Livestock Production in Kenya, IGAD, IFAD, 2013
33. Poverty Environment Initiative project and National Environment Management Authority:
34. Pradhan Mantri Adarsh Gram Yojna (PMAGY) Baseline Survey of a PMAGY Village; Guidelines: Government of India Ministry of Social Justice and Empowerment The strategy prepared with support from European Union Energy Initiative Partnership & National Institute of Rural Development, Hyderabad. August, 2010
35. Resource Users Associations in Water Catchment Management in Tharaka – Nithi County: 2012

APPENDICES

APPENDIX 1: TERMS OF REFERENCE

2.0: Objectives of the study

The objective of the study is to generate baseline data that will help in assessing the situation at the start of the project, set bench marks/indicators to inform the M&E function of the project and form a platform for assessing the outcomes and impact of the project. The data generated by the study will help in reviewing the project log frame. The study will provide comprehensive information for planning and decision-making besides providing benchmarks against which programme interventions will be assessed and will be a reference point when organizing other surveys. The data provided by the study will contribute in setting up a Management Information System (MIS) at the PCT.

The study will target the ***priority twelve (12) river basins and the tributaries of the five (5) river basins formally under MKEPP as per table below;***
MKEPP River Basins (5)
Ena (Gitimbogo, Thura, Kuuru, Rwanjoga, Kirini, Mavuria, Riachina, Gangara, Kiambere)
Kapingazi/Rupingazi (Kiye, Thambana, Nyanjara, Gichangai, Itabua and Kathita)
Kathita (Rugusu, Kathita Munyi, Gachiege, Kanyango, Nganyuma, Kinyaritha, Kuuru, Riiji)
Mutonga/Kithinu (Naka, Nithi, Maara South, Maara North and Thuci)
Tungu (none)

High Priority River Basins for UTaNRMP
Maragua, Murubara, Nairobi, Ragati, Rujiweru, Rupingazi, Saba Saba, Thangatha, Thanantu, Thiba, Thika/Sasumua, Thingithu

2.1 Specific Tasks

The project intends to carry out a baseline study covering the following four main aspects:
- Socio-economic
- Water resources
- Environmental and
- Agricultural/ rural livelihood

Besides these specific areas, the consultant is expected to assess all project indicators and targets and update the log frame indicators where necessary.

2.1.1 Social-economic issues

a) Undertake a socio-economic review for each of the six counties (Embu, Tharaka Nithi, Meru, Nyeri, Muranga and Kirinyaga) covering:
• Population status (average size of HH, structure and distribution);
• Identify sources of income, average incomes per household per annum and the proportion of the sources of the income;
• Establish type of houses (temporary, semi- permanent and permanent), proportion and their distribution;
• Establish main assets owned by the beneficiaries, their proportions and distribution.
• Establish literacy levels in the project area (Primary, secondary, Tertiary, university);
• Establish the main land tenure system in the project area and average land holding per HH
• Establish the types and sources of farm labour in the household.

b) Establish ways of communities' participation in community projects and their proportions.
c) Take inventory of NGOs, CBOs and self-help groups' profiles including their activities, membership, funding sources and geographical location along the 12 river basins.
d) Identify proportion and distribution of people living in absolute poverty and those in need of special interventions (People with Disability, elderly and orphans).

2.1.2 Water Resource issues

a) Inventorize and document all WUA's and WRUA's noting their membership and management structure. Describe also the main activities of the WRUA's/WUA's.
b) Establish whether the WUAs in (a) above are registered with the WRUA or not.
c) Inventorize and geo-reference all wetlands, springs, dams, hotspots (degraded areas), describe the type of land use surrounding them and determine incentives to encourage farmers to conserve them.
d) Identify and geo reference the main water pollution sources within the river basins, and describe the type of source
e) Within the river basins, inventorize all the water supply systems (Irrigation and Domestic
supply, company or private and individuals systems). Describe the condition of the infrastructures and its efficiency, the management structures, whether they have a water permit. (Indicate the number) or don't have,
f) Establish the number of households with safe drinking water per river basin.
g) Establish the area (Ha) under irrigation, methods of irrigation and their proportionate irrigation areas (Ha) per river basins.

2.1.3 Environmental issues

a) Inventorize the CFA's and their status, Registration, membership, number of CIGs, roles, activities and benefits

b) Undertake an inventory, status and extent of hot spots in agricultural lands and riverbanks (gullies, sand harvesting sites, quarries, landslide prone areas etc.) and geo-reference the sites.
c) Establish the road sites prone to erosion and determine the extent of the area (KM)
d) Identity hilltops and their ownership status (gazetted, trust lands, community), levels of degradation per hilltop (ha), presence of a CFA and propose relevant rehabilitation methods.
e) Document the degraded areas in the gazetted Forested areas (Ha per Forest Station) and in the project area and recommend the required tree species for rehabilitation.
f) Determine the levels of human/wildlife conflicts in the project area-type of conflict, main problematic animals, and damages caused, coping mechanism and recommend the ways to reduce the conflicts.
g) Establish the types of energy saving devices, level of the utilization and recommend ways of increasing adoption rates.
h) Establish the extent of use of improved charcoal kilns in the project area and recommendways of increasing adoption and their efficiencies.
i) Inventorize alternative energy sources (green energy), % number of users, utilization levels, distribution, potential and recommend ways of increasing the adoption rates.
j) Determine the community awareness levels on natural resource management issues withinthe 12 river basins.

2.1.4 Agricultural/Rural Livelihoods

a. Establish the main economic activities within the 12 river basins and the tributaries of 5 MKEPP river basins
b. Establish the main land use patterns along the 12 river basins the tributaries of 5 MKEPP river basins;
c. Establish the main soil types along the 12 river basins the tributaries of 5 MKEPP river basins;
d. Determine the main soil and water conservation hotspots and recommend appropriate remedies;
e. Establish the main soil and water conservation measures used by farmers along the river basins and the proportions of each type;
f. Establish the % of farmers using improved seeds of major crops by types and proportions.
g. Establish the % of farmers using various technologies in crops, livestock, apiculture, fishing and aquaculture and the proportions of each;
h. Establish the major cropping activities in relation to types of crops grown, production levels and distribution and challenges faced for increasing production;
i. Establish the number of farmers and area (Ha) under horticultural farming, crops grown and their productivity levels;
j. Establish the main livestock production practices by profiling the livestock types

distribution and productivity level;

k. Inventorize the marketing channels and facilities used by the producers and traders in
l. marketing their produce/products and wares and recommend ways of improving marketing.
m. Establish % of farmers who belong to primary producer, secondary and tertiary marketing groups;
n. Inventorize the main sources of credit by category of financial institution, lending conditions and % of farmers who have access to financial services and by type;
o. Establish the number and type of agro- based processing facilities, value addition, cottage industries and establish their potential in the project area;
p. Means of livelihood/ farming systems (crops grown both cash, horticultural and food crops, livestock types and numbers, Beekeeping status);
q. Average proportion of farm under crops and income per unit area (Ha);
r. Establish the fish processing facilities and hatcheries within the 12 river basins;

2.1.5: Community Empowerment and Participation

a. Document the key financial management issues among the target communities;
b. Document the current community procurement methods and major procurement issues
c. raised;
d. Assess levels of community participation in planning, implementation and sustaining rural projects;
e. Identify other players in NRM in the project area.

2.1.6: Project Management and Coordination

a) Assess the effectiveness of project management structures
b) Assess the effectiveness of project financial management and procurement
c) Assess the effectiveness of the project Monitoring and Evaluation
d) Assess the effectiveness of the project Knowledge Management and Learning

APPENDIX 2: DATA COLLECTION TOOLS

UTANRMP BASELINE SURVEY – HOUSEHOLD QUESTIONNAIRE

Enumerator:…… Date:……..

1. Name of Respondent (optional)	
2. Household Head	□ Male □ Female
3. River Basin	
4. WRUA (name) and location (river segment)	□ Upper □Middle □ Lower
5. GPS Location	
Socio-Economic Data	
6. What is the total land area (acres) that HH has	
7. What is the farm ownership status of the area?	□ Private with titles □ Private with No titles □Communal □ Family held □ Other (please specify)
8. What is the number of persons in the Household	
9. Literacy level of HH members (insert number of persons in each level)	[ ] Primary level [ ] Secondary level [ ] College / University [ ] Others. Please specify_____
10. Number of houses on farm and their uses (list)- residential, barn, bathroom	
11. Type of house (s)on farm	□ permanent □ semi-permanent □ temporary
12. Main assets owned by household (please tick, but where more than one, put numbers)	□Motor bikes ____ □Cars _____ □ Water tank □ TV □ Radio □ Bicycles □ Mobile phones □ Gas cooker □ gas cylinder □solar panel□ others (list)
13. What is the occupation of household members (insert number in each segment)	[ ] Formal employment [ ] Informal employment [ ] work in own farm [ ] Self employed [ ] Others. Please specify_____
14. Average total HH income per year	□0-10,000 □ 10,000 – 50,000 □50,000 -100,000 □100,000 – 200,000 □ 200,000 – 300,000 □300,000 – 400,000 □400,000 – 500,000 □500,000 – 1 million □over 1 million
15. Main sources of income for HH (list in order of priority – formal employment, casual labour, milk sales, agricultural produce sales indicating approx. amounts)	

16. How is the HH income spent?(approx. per annum) – school fees, farm inputs, livestock inputs, new investments, energy, water etc.	
17. What is the main source of water for the household?	□ Piped connection □ Spring □ River □ Borehole □ Well □ Dam
18. What is the distance to the water sources from the HH? (kms)	
19. What is the main source of lighting for the household?	□ Kerosene lamp □ kerosene tin lamp □ Electricity □Solar lantern □ Solar home system □ Candles □ Biogas □Other (specify)
20. What is the main source of cooking energy for the household?	□ Firewood □ Charcoal □ Agricultural wastes □ Biogas □LPG □ Electricity □ Briquettes □ Other (specify
21. Who is involved in farm production in the family (list) (separate labour from family involvement)	□Parents _____ □ Children _____ □ Permanent hired labour _____ □Temporary hired labour _____
22. Is there any mechanized work on farm?	□Tractor □ Water pumps for irrigation □Mechanized sprays □ Others (specify)
23. Are family members involved in community groups?	□Yes □No If yes name the type of groups If No, why?
24. Are the family members aware of the existence of WRUAs?	□Yes □No
25. Are the family members aware of CFAs in the area?	□Yes □No
26. Do, you know of people living with disability in the areas? How many and types of disability?	□Yes □No If Yes, how many and what type of disability? [ ] Physically handicapped [ ] Blind [ ]deaf and Dumb [ ] Mentally challenged [ ] Others, specify
27. Are you aware of any assistance they might be getting?	□Yes □No If Yes, what assistance, and by whom
28. In your area, how do people describe people living in poverty?	
29. In any ten people that you know in this area, how many do you know who are in abject poverty?	□Yes □No
30. How do they cope with the poverty situation?	

Water Resource Issues	
31. Is the source of your water treated?	□Yes □No
32. Other than your primary source, are there other water sources in the locality?	Yes □No If Yes, name them (list)?
33. What is the distance of these water sources from your HH? (kms)	
34. Do you harvest rain water?	□Yes □No If No, why
35. Are you a member of a water project, and what is the name of the project?	[ ] Yes [ ] No If Yes what is the name of the project
36. For what use is the water supplied used for?	□ Domestic□ Irrigation
37. How many members does the project serve?	
38. Does the water project have the requisite permits?	□Yes □No If No, why
39. Where is the intake for the water project?	
40. How far is the intake for the water project?	
41. What infrastructure does the water project have(intake, pumps, pipes)	
42. What is the condition of the infrastructure (intake, pumps, pipes)	
43. Do you pay for water?	[ ] Yes [ ] No If Yes what do you pay_____ How do you pay?_____
44. Do you irrigate your land?	□Yes □No
45. If yes, what method do you use?	□ Drip □Overhead □ Buckets □Other (specify)
46. What crops do you grow under irrigation? (list) and what is the area under each of these crops?	
47. Are there problems in accessing water in the project?	□Yes □No If Yes, what
48. Is there any water rationing in the project?	□Yes □No If Yes, how is rationing undertaken ?

49. Are there any water use conflicts in the project, or with other water projects in the area?	□Yes □No If Yes, what
50. Is there a known place/area where water gets polluted in this area ?(probe for factories, small town centres etc.	□Yes □No If Yes, what
51. What is the name of the pollution spot and how far is it from the HH?	
52. Is there a wetland, spring,dam, collapsing river bank, in the locality?	Yes □No If Yes, what is its name, where is it located and how far from the HH
53. What activities take place around these bodies - wetlands, springs,dams, river banks, in the locality?	Yes □No If Yes, what is its name, where is it located and how far from the HH
54. Are these dams, springs, wetlands protected?	Yes □No If Yes, by whom? If No, why?
55. What challenges are there in protecting these wetlands, springs, dams,?	
56. What would the community in this area require to be able to protect these springs, wetlands, dams and degraded areas?	
57. Are there any illegal abstractions in the locality?	Yes □No If Yes, where? How far from the HH?
Environmental Issues	
58. Does farmer undertake tree planting on farm	□Yes □No If yes, which are the most common tree species planted?
59. What is the main reason for tree planting on farm? (list in order of priority)	
60. Does farmer undertake tree planting in the forest area?	□Yes □No If yes, which are the most common tree species planted?
61. What is the main reason for tree planting on forest land? (list in order of priority)	
62. What is the sources of tree seedlings for planting?	
63. What is the distance of nursery from HH?	

64. What are the average prices per species ?	
65. Are there any environmental challenges in the area (probe for challenges – climate change, pollution etc.) .	
66. How do these environmental problems in the area affect you? (health, smell, water pollution, lack of rainfall)	
67. How are these problems being tackled by the community?	
68. Are they being tackled successfully?	□Yes □No If No, what support is required?
69. Are there any groups in the area dealing with environmental issues or NRM?	□Yes □No If Yes, where What is their main activity
70. Have you attended any course on environment or natural resources management	□Yes? □No If yes which one
71. What benefits have you seen from managing environment?	
72. Where do you source your firewood from?	□Farm □ Forest □ Collecting from community areas □ Market (purchased) □ Other (specify)
73. How much time do you use to get firewood?	
74. What distances do you cover to get firewood?	
75. Where do you get your charcoal from?	
76. Do you know how it is produced and where?	Yes □No If Yes, how and where
77. What distances do you cover to get kerosene?	
78. What cooking appliance do you use?	□ Three –stone jiko□ Normal charcoal jiko □Maendeleojiko□Upesijiko□Jikokisasa/Kunimbili □ Kenya Ceramic Jiko□ Rocket Jiko□Uncladded liner □Kerosene stove □LPG cooker/Meko□ Electricity cooker □ fireless jiko□ Other (specify
79. Do you use any alternative energy types (green energy)?	□Biogas □Solar power □Briquettes □ Biofuels □Other (specify)
80. Where did you learn about green energy?	

81. What recommendation would you give to improve its uptake?	
82. Are there any human-wildlife issues in the area?	□Yes □No If Yes, where ? (name of area)
83. What is the main type of conflict?	
84. What is the main type of damage caused?	
85. What are the main problem animals? (list)	
86. How do the community members do when wildlife invades their areas?	
87. Is there any compensation given after wildlife damage?	□Yes □No If Yes, what?
88. Is there a source of pollution in the area ?(quarry, factory)	□Yes□No If yes, where is it located?
Agriculture/Livelihoods	
89. How is your land divided for tis various uses (area in acres)?	Food Crops:……..Cash crops:……. Livestock:…….. Fallow:…… Trees:……Other:…….
90. What main crops do you plant for both food and crops? (list in acreage)	[ ] acres Tea [ ] acres Coffee [ ] Bananas [ ] acres Maize [ ] Beans Others [ ] acres ……. [ ]acres ……. [ ] acres [ ]acres ;…….
91. How are the soils in your farm as regards fertility?	□ High □ Moderately high □ Moderate □ Variable □Low □Very low
92. Are there problems with soil and water conservation in the area?	□ Yes □ No If yes, is there a degraded area in the locality
93. What soil and water conservation structures/methods are used in the area? (list)	□ Bench Terraces □Fanyaa Juu terraces □Nappier grass □ Planting along contours □ Others (specify)
94. Which methods do you use?	
95. Do you use certified seeds for planting?	□ Yes □ No If No, why
96. For what crops do you use certified seeds for planting? (list)	
97. Do you use fertilizers for planting and crops husbandry?	□ Yes □ No If No, why

98. Do you use green houses for crop production?	□ Yes □ No
99. Are there farmers using greenhouses in the area?	□ Yes □ No If yes, what do they grow?
100. Do you grow any horticultural crops?	□ Yes □ No If yes, what do you grow? (list in order of priority)
101. What are the yields for the various horticultural crops grown? (list)	
102. Do other farmers grow horticultural crops in the area?	□ Yes □ No If yes, what do you grow?
103. How are horticultural crops sold in the area?	□ Grown by contract and sold to particular firms □ Sold together in groups □Sold in local market □ Bought at gate by middle men □ Others (specify)
104. What are the main challenges in horticultural production in the area? (list)	
105. Are there new agricultural technologies in the area?	□Aquaculture □Apiculture □ Improved chicken □Rabbits □Piggeries □Dairy goats □ Tree farming □Commercial fruit growing □Others (specify)
106. Out of every ten farmers in the area, how many have adapted the new technologies? (list percentages)	[ ] Aquaculture [ ] Apiculture [ ] Improved chicken [ ] Rabbits [ ] Piggeries [ ] Dairy goats [ ] Tree farming [ ] Commercial fruit growing [ ] Others (specify)
107. Are there any fish processing facilities in the area?	□ Yes □ No If yes, what is the name of the facility and where is it located?
108. Are there any hatcheries in the area?	□ Yes □ No If yes, what is the name of the facility and where is it located?
109. What main livestock breeds do you keep on farm? (list numbers)	[ ]Jersey [ ]Guensey[ ]Fresian[ ]Zebu [ ]Aryshire[ ]Sahiwal[ ]Boran[ ] Sheep [ ]Doba[ ] Dairy Goat [ ]Local chicken [ ]Ken brow [ ] Rabbit [ ]Others (specify)
110. What is the yield of the crops listed per year/season? (list in Kgs/tonnes per ha)	
111. What prices do you fetch for the various crops when sold? (list)	
112. What is the distance to the market?	

113. What are the main challenges in crop production? (list)	
114. What is the milk yield of the livestock listed per day? (list in Kgs/Litres)	
115. What is the price of milk per litre/Kg?	
116. Where, or how do you sell your milk?	
117. What is the meat yield of the livestock listed month? (list in Kgs and get selling frequency)	
118. At what price do you sell your livestock? (list per breed and age)	
119. Where do you sell your livestock products?	
120. What form of livestock husbandry is practiced by farmers?	□Zero grazing □Free grazing □ grazing in paddocks □ Other (specify)
121. How do you control ticks and disease in livestock?	□ Dipping □ Spray race □ Hand spraying □Others (specify)
122. Whatlivestock fertilization facilities are used in your area?	□ A.I □Bulls If both, which is most popular?
123. What are the main challenges in livestock production? (list)	
124. How do you tackle these challenges?	
125. Do you have organizations which sell their products together in the area?	□Yes □No
126. If yes list the organizations and what they sell?	
127. How do most people sell their crops? (list crops and marketing chain)	
128. How do most people sell their livestock products (list livestock products and marketing chain)	
129. Are there any agro-processing companies in the area?	□Yes □No If Yes, which ones?
130. Are you a member of any marketing group?	□Yes □No If Yes, what do you market?
131. Do people in the area have bank accounts?	□Yes □No If No, give reasons, if Yes, describe

132. What banks/financial institutions are most active in the areas? (list)	
133. What facilities do these institutions offer to farmers? (list)	
134. What are the lending condition of these institutions to access credit? (list)	
135. Of every 10 persons you know in the area, how many do you know who have accessed credit from these institutions? (list)	
136. Which is the most used financial institution for credit?	
137. Are there any self help groups who do table banking?	

UTANRMP BASELINE SURVEY – KEY INFORMANT INTERVIEW GUIDE

1. SOCIAL-ECONOMIC ISSUES

1. Key Informants: County/District social development officers; County/District development officers; youth officers

1) What is the County population by gender, age group
2) What is the distribution of the population across the county
3) What is the population density in the county – sub-counties
4) What is the average household sizes
5) What is the average age structure of household members
6) What are the main economic activities for male, female and youth in the county and in the river basin
7) What are the main sources of household incomes in the county/river basins
8) What is the approximate average incomes per household per annum in the county/river basin?
9) Who are the main income earners in the households?
10) What types of community projects exist in the county/river basin?
11) Are there projects dealing with natural resources management? Which ones?
12) How are community members involved? (in what activities, as groups or as individuals?)
13) Which community members are involved?
14) What is the poverty levels in this area?
15) What is the distribution of poverty across the county?
16) What are the main causes of poverty
17) What is the number of vulnerable persons in the area and county per group – persons with special needs, orphans, aged, persons with disability
18) What is the distribution of these persons in the county/sub-county?
19) Number of people in need of special needs
20) How are the vulnerable people involved in community groups?
21) How are vulnerable persons regarded in the community?
22) What type of assistance is available to vulnerable persons?
23) Who are the main providers of this assistance?
24) What number of NGOs, CBOs and registered groups are found in this area?
25) Are they active?
26) What is their membership by age, gender?
27) What are the main activities they are involved in?
28) What are their key sources of funding?
29) What is the capacity of these groups/organizations in successfully undertaking their mandate?
30) What financial institutions are found in this area?

31) What financial services dothey offer to community members and groups?
32) Do community members access these institutions?
33) If not, what are the main challenges?

2. Key Informants: County/District education officers; school principals;

1) What is the average literacy level in the county and in the river basin area?
2) What are the school enrolment rates in the county and river basin area?
3) What are school drop out rates in the county and river basin area?
4) What is the number of institutions found in the county and river basin areas – pre-primary, primary, secondary, technical, and tertiary
5) What is the performance of these institutions in national exams

2. WATER RESOURCE ISSUES

1. Key Informants: WRMA(includes some environmental issues)

1) What is the number of WRUA's including their registration status, membership, activities, and management structure;
2) How many of the WRUAs had formulated SCMPs
3) How are the SCMPs being implemented
4) How many of the WRUAs/SCMP activities been funded by WSTF
5) What are the main activities of the WRUAs
6) How strong are their governance structures?
7) What are the main challenges in the river basin?
8) How can the WRUAs address these challenges?
9) What are the main challenges facing WRUAs in the river basin in addressing these problems?
10) In what ways can WRUAs be strengthened to tackle the challenges in their respective areas?
11) Which springs , wetlands, dams, exist in the river basin, and what is their approximate location along the river basin? (get GPS locations if available)
12) What are the key activities around these sites?
13) What are the main challenges for these key ecosystems?
14) What incentives or strategies can be used to ensure communities protect or exploit these sites sustainably?
15) What are the main types of spot and diffuse pollution sources in the river basin?
16) What are their approximate locations within the river basin? (get GPS locations if available)
17) What is the extent and status of pollution and environmental degradation in agricultural lands, roads, and river banks, and where are these sites located?
18) What is the total coverage per river basin in square kilometres

2. Key informant: Water offices and Water and Sanitation Companies

1) What is the number of WUAs including their registration status, membership, activities, and management structure;
2) What are the main activities of the WUAs
3) How strong are their governance structures?
4) What are the main challenges in the river basin?
5) How can the WUAs address these challenges?
6) What are the main challenges facing WUAs in the river basin in addressing these problems?
7) In what ways can WUAs be strengthened to tackle the challenges in their respective areas?
8) Which are the water supply systems and types within the river basin (s);
9) Who are the owners of the water supply systems?
10) What is the condition of the water supply infrastructure?
11) What is the management structure of the water supply services?
12) Do the water supply systems have the requisite permits? (ask for copies)
13) What is the approximate umber of households in the river basin(s) with access to safe drinking water?

3. County NEMA offices(Questions include those for Environmental issues)

1) Which springs , wetlands, dams, exist in the river basin, and what is their approximate location along the river basin? (get GPS locations if available)
2) What are the key activities around these sites?
3) What are the main challenges for these key ecosystems?
4) What incentives or strategies can be used to ensure communities protect or exploit these sites sustainably?
5) What are the main types of spot and diffuse pollution sources in the river basin?
6) What are their approximate locations within the river basin? (get GPS locations if available)
7) What is the extent and status of pollution and environmental degradation in agricultural lands, roads, and river banks, and where are these sites located? (gullies, sand harvesting, quarries, landslide prone areas, road sites
8) What is the total coverage per river basin in square kilometres?
9) What is the level of environmental awareness/natural resources management in the county?
10) What programmes does NEMA have on environmental education in the area?
11) How can environmental awareness be increased?
12) Who are the key players in NRM in the area?

4. County Irrigation Office/County Agricultural Office (Questions include those of Agriculture/Livelihood section)

1) Is irrigation practiced in the river basin
2) What is the approximate land under irrigation (overall and average per individual farm)
3) What percentage of land is irrigated in the river basin?
4) What are the main methods of irrigation used?
5) What is the efficiency of the irrigation system used?
6) Is there sufficient water for irrigation?
7) Are there water use conflicts arising from irrigation?
8) What are the main crops grown under irrigation?
9) How are these crops marketed?
10) Are crops grown under contracts?
11) What is the extent and status of pollution and environmental degradation in agricultural lands, roads, and river banks, and where are these sites located?
12) What is the total coverage per river basin in square kilometres?

3. ENVIRONMENTAL ISSUES

1. Key Informant: Ecosystem conservators, Foresters and other KFS staff

1) What is the number of the CFAs in your area and their names?
2) What is their registration status and membership?
3) Have they prepared a Participatory Forest Management Plan?
4) Have they signed a Management Agreement with KFS?
5) What is the implementation status of the plans?
6) What is the number of CIGs under the respective CFAs?
7) What are their main roles and activities in forest management?
8) How do CFA's benefit forest management?
9) What benefits accrue to them - CFA and CIGs?
10) What is the management and governance structure of the CFA?
11) What is the capacity of the CFA to fulfill its mandate as per the management plan and agreements?
12) What are their capacity building needs? (of CFAs and CIGs)
13) How many hill-tops are in the county?
14) What is their ownership status?
15) What are they used for and by whom?
16) Are they well protected or degraded?

17) Do they have a CFA?
18) What is the number and name of hotspots in the forest area? – degraded hilltops, forests, wetlands, and roads
19) What is the number of sites and total area of degraded forest sites per forest station? (name of sites/blocks)
20) Have there been any forest rehabilitation activities in the forest?
21) Who were the main sponsors?
22) Which tree species are required for forest rehabilitation?
23) What is the level of tree planting on farms?
24) What are the preferred tree species?
25) Where are tree seedling procured from?
26) What is the number of nurseries in the area, and their seedlings stocking?
27) Who supports the tree nurseries?
28) Are there any environmental groups in the area?
29) What are their main activities?
30) Who supports these groups?
31) From your assessment, what assistance would these groups require to fulfill their mandate?
32) Have there been any environmental awareness campaigns in the area?
33) What did they focus on?
34) Who supported the campaigns?
35) Are there any registered charcoal producers in the area?
36) What are their production methods? (do they use improved kilns, or methods)
37) How can charcoal production efficiency be improved?
38) Who are the key players in natural resources management in the region?

2. <u>Key informant: Kenya Wildlife Service Warden</u>

1) Are there any human-wildlife conflicts in the area?
2) What is the main type of conflict?
3) What are the main problem animals?
4) What is the most common damage caused?
5) What are the communities coping mechanisms?
6) What recommendation would you give to mitigate the conflicts?
7) If human-wildlife conflicts only existed in the past, how were they mitigated?

3. <u>Key informants: Ministry of Energy Centres</u>

a) What types of energy efficient technologies for cooking and lighting are used in the area?
b) Is their use widespread?
c) What is the main challenge in their uptake?

d) Is there sufficient awareness on the use of these technologies?
e) Who are the main producers and distributors of these technologies?
f) How can the uptake of these technologies be improved?
g) How is use of green/alternative energy sources in the area?
h) What is the approximate number of users?
i) How are these users distributed in the county/area?
j) How can alternative sources of energy be promoted?

4. AGRICULTURAL/RURAL LIVELIHOODS

1. Key informant : County and Sub-county Agricultural officers/Irrigation Officers

1) What are the main economic activities?
2) What is the main land –use pattern in the area?
3) What is most common land tenure in the area?
4) Do women and youth have land access, security?
5) Who owns land, who can access it?
6) What is the average land size per household?
7) What are the types and sources of farm labour for households in the area ?
8) What are the main soil types – fertility levels?
9) What are the main soil and water conservation structures?
10) Which area in the region has key challenges in soil and water conservation?
11) What are the names and locations of these areas?
12) What is the total area of agricultural land is degraded?
13) What are the key agricultural inputs used by farmers in the area
14) What are the main challenges in agricultural production and livelihoods;
15) What is the impact of climate change on agricultural production and how they are mitigated;
16) Are other types of other farming technologies like apiculture and aquaculture known and practiced in the areas?
17) What percentage of farmers are practicing the new technologies?
18) What are the major food and cash crops grown in the area?
19) What are the average production levels for each crop?
20) What are the key challenges of crop production and how can these be overcome?
21) Is there any horticultural production?
22) What are the main crops grown?
23) What is average area per farms for horticulture?
24) What is the production system for horticulture?
25) How are these crops marketed?
26) How are other crops marketed?
27) How can market challenges be overcome?
28) How is livestock production in the area?

29) What are the key livestock breeds in the area?: (chicken, rabbits, cows, goats etc.)
30) How is livestock production in the area?
31) How are the yields?
32) What is the most common husbandry method used?
33) What livestock inputs are used in the area?
34) What challenges are there in livestock production?
35) How can these challenges be addressed?
36) What financial institutions give credit to farmers and communities
37) What challenges are there in accessing credit?
38) How can these challenges be overcome?

UTANRMP BASELINE SURVEY – FOCUSED GROUP DISCUSSIONS INTERVIEW GUIDE

5. NGO's , SHGs, CIGs, and CBOs

- What is the name of the organization?
- When was it founded, and by whom?
- What is the membership to organization(no, gender, age)?
- What is the governance structure of the group?
- Is the group registered?
- Where is it registered?
- Does it have a constitution?
- Does it follow the constitution?
- Does it have duly elected officials?
- Activities they are involved in?
- What is the capacity of the group to undertake their mandates/activities?
- What are the group's future plans ?
- What is the sources of the organizations funding?
- How does organization manage its finances?
- Does organization have a bank account?
- How does organization undertake it procurement?
- How does organization undertaken financial reporting?

6. WRUAs AND WUAs

- What is the name of the WRUA/WUA ?
- When was it established?
- What is the membership to organization (groups, CIGs, factories)?
- What is the governance structure of the group?
- Is the group registered with AG?
- Does the group have an MOU with WRMA?
- When was it registered?
- What area does it cover (or length of river/tributary)
- Does it have duly elected officials?
- What activities are you involved in?
- What is the capacity of the group to undertake their mandates/activities?
- What are the group's future plans ?
- Has the group formulated a SCMP?
- What is the sources of the organizations funding?
- Has the WRUA been funded by WSTF?
- What level of funding and for which activities?

- How does organization manage its finances?
- Does organization have a bank account?
- How does organization undertake it's procurement?
- How does organization undertaken financial reporting?
- What are the key benefits of the WRUA/WUA?
- What are your key challenges?
- What kind of support would the organization require to be able to fully meet their mandates and implement their planned activities?

7. **CFAs**
    - What is the name of the CFA?
    - What is your forest station?
    - When was it founded?
    - What is the membership to organization (no, gender, age)?
    - What is the governance structure of the group?
    - Is the group registered by the AG?
    - Has the CFA undertaken the formulation of a Participatory Forest Management Plan?
    - Has CFA signed a management agreement with KFS
    - Does it have a constitution?
    - Does it follow the constitution?
    - Does it have duly elected officials?
    - How many CIGs constitute the CFA?
    - ARE CIGs registered?
    - What activities do the CIGs engage in?
    - What is the capacity of the CFA and the CIGs to undertake their mandates/activities?
    - What are the groups' future plans ?
    - What is the sources of the organizations funding?
    - How does organization manage its finances?
    - Does organization have a bank account?
    - How does organization undertake it procurement?
    - What are the benefits of having a CFA?-to government and to community
    - What are the main challenges and how can they be sorted?

APPENDIX 3: LIST OF PEOPLE MET AND CONTACTED

NO.	Name	Designation
1.	Mr. Henry Mwenda	Agricultural Crop Officer, Maua
2.	Ms. Celina	Department of Livestock Maua
3.	Mr. Fredrick Kiiru	District Education Officer Maua
4.	Mr. Patel	Forester Maua
5.	Mr. Mutuma	Chairman Ura WRUA
6.	Mr. Eustace N. Nyaga	Chairman Ruguti Water Project
7.	Mr. Silas Mugendi Paskwale	Chief Magumoni Location, Tharaka Nithi
8.	Mr. Mwangi	Assistant Manager Bendor Estate in Thika River Basin
9.	Mr. Kingori	Manager, Bendor Coffee Estate
10.	Mr. David Muchiri	Brenan Flower and Coffee Farm
11.	Mr. Cyrus Mwaura	Production Manager, Thika Water Supply Company
12.	Mr. Nyaga	Ruchuu Irrigation Project Thika River Basin
13.	Mr. Ephantus Magondu	Chairman Kiiye WRUA
14.	Mr. Adel Nyaga	Treasurer Kiiye WRUA
15.	Chief Henry Ngai Gauka	Thuita Location, Ruguti River Basin
16.	Mr. Kiragu	Water Office, Tharaka Nithi
17.	Chief Gerald Gicheru	Chief, Kamwimbi Location Tharaka Nithi, Thucii River Basin
18.	Mr. Alexander Njeru Meri	Secretary, Kavando Water Project, Kamwimbi, Thucii River Basin
19.	Mr. Simon Mangi	Chief, Kanjuki Location, Mara River Basin
20.	Mr. Joshua Machali	Field Officer, Upper Thanantu River Basin, Mikinduri
21.	Mr. Gerald Maingi	Chief, Kawethu, Thanantu River Basin, Tharaka Nithi
22.	Mr. Wilson Gacaura	Nkondi Location, Thanatu River Basin, Tharaka Nithi
23.	Mr. Simon Nthiga	Snr. Chief Kanjuki Location, Tharaka Nithi
24.	Mr. Japheth Mukengu	Chief Kamaindi Location, Tharaka Nithi
25.	Mr. Paul Muimbi	Chief, Karocho Location, Thingithu River Basin, Tharaka Nithi.
26.	Mr. Valerio Gaichura	Chairman, Riungu Karocho Furrow Irrigation Project
27.	Mr. Joram Muthengi	Chief, Marimanti, Thingithu River Basin
28.	Mr. Collins Mwendga	Chief Mukuri Location, Ruguti River Basin, Tharaka Nithi
29.	Ms. Dorothy Kinywa	Assistant Chief, Ikuu Sublocation, Thingithu River Basin, Nkubu
30.	Ms. Naomi Wanjiku	Frigokin Horticulture Project, Thingithu River Basin, Nkubu
31.	Ms. Loise	Secretary, Hombe CFA
32.	Mr. Njue Mathuko	Irrigation Officer, Maua

NO.	Name	Designation
33.	Mr. Mutuma Kienja	Matinya Water Project , Thingithu River Basin, Nkubu
34.	Mr. Julius Mwiti	Bwathonaro WRUA
35.	Mr. Joseph Baario	Kanje 11 water project
36.	Mr. Andrew Kiremi	Guneke Self Help Group, passion fruit and fish farming, Thingithu River Basin, Nkubu
37.	Mr.Francis Kyambi	Secretary Guneke Self Help Group
38.	Ms. Loise Kinoti	Treasurer, Guneke Self Help Group
39.	Mr. Richard Mulelwa	Kambogo Irrigation Project, Kuuru River Basin, Lower Imenti
40.	Mr. Shadrack Thuranta	Kuuru WRUA
41.	Mr. Rufus Mugambi	Kuuru WRUA
42.	Mr. William Kaberia	Gakinya WRUA
43.	Mr. Peter Muriithi	Gakinya WRUA
44.	Mr. Musa Mwithalii	Member Ura WRUA
45.	Mr. Eliphas Kinywa	Assistant Chief Iraru River Basin, Mweru Location
46.	Mr. Henry Mutwiri	Chairman Mirurii Furrow Irrigation Project
47.	Mr. Joseph Ndegwa	Chairman Sagana River Basin WRUA
48.	Mr. Gerald Gicheru	V.Chairman Sagana WRUA
49.	Mr. Linus Kihara	Secretary Sagana WRUA
50.	Pastor Jane Wanjiru	Treasurer Sagana WRUA
51.	Mr. Wilson Kamuki	Mutarakwa Farm Tree Nursery, Sagana River Basin
52.	Mr. Jackson Gikonyo	Ebenezer Trout Farm, Sagana River Basin
53.	Ms. Mary Gathoni	Deputy, Wambugu Farm Renewable Energy Center in Nyeri.
54.	Mr. Jeremiah Ntumarete	Chairman Ntugi CFA
55.	Mr. Martin Murianke	Treasurer Ntugi CFA
56.	Mr. Jeffrey Kinoti	Secretary Ntugi CFA
57.	Mr. I. M. Gikonyo	Chairman, Muringato WRUA
58.	Ms. Irene Mwangi	Secretary Muringato WRUA/Representative Kimathi University
59.	Mr. J. Mungai	Environment Officer, Nyeri Hill Farm, Catholic Diocese of Nyeri.
60.	Ms. Rose Wanjohi	Muringato WRUA
61.	Mr. Stephen Nderitu	Muringato WRUA
62.	Mr. Francis Ndumia	Muringato WRUA
63.	Ms. Grace Wangui	Muringato WRUA
64.	Mr. Daniel Kimani	Chairman, Chania WRUA
65.	Mr. Munyiri	Secretary, Chania WRUA
66.	Mr. James Muriuki	Thiba WRUA
67.	Ms. Margaret Magara	Water Resources Management Authority (WRMA)

NO.	Name	Designation
		Tana Regional Office - Embu
68.	Ms. Lilian Kinyua	WARMA sub-regional office
69.	Mr. Njagi	WRUA member
70.	Mr. Abel	WRUA member
71.	Mr. Njara	Farmer
72.	Mr. Nyongesa	Sub Regional Office - Muranga
73.	Ms. Lucy	Sub Regional Office - Muranga
74.	Mr. BenardNgoruse	Sub Regional Office - Kerunguya
75.	Mr. Munyiri	Sub Regional Office - Kerunguya
76.	Ms. Jane Njuguna	Farmer
77.	Ms. Phyllis	Farmer
78.	Mr. James Maina	Sub Regional Office - Meru
79.	Mr. Munene	Chairman, Lower Rwamuthambi WRUA
80.	Mr. Gabriel Mbugi,	Chairman Upper Rwamuthambi WRUA
81.	Ms. Florence	Chairman Lower Thiba WRUA
82.	Mr. Kilonzo	Farmer, Lower Thiba river
83.	Mr. Kibaki	Tana Water Services Board (TWSB)
84.	Mr. Irari	TWSB Office - Nyeri
85.	Mr. Samuel	Commercial manager, Kirinyaga Water and Sewerage Company (KIRIWASCO) - Kiruguya
86.	Eng.Karungendo	M.D. Kirinyaga Water and Sewerage Company (KIRIWASCO) - Kiruguya
87.	Mr. Mbae	M. D. Embu Water and Sewerage Company (EWASCO) - Embu
88.	Mr. Muchai	Meru Water and Sewerage Company (MEWASS) - Meru
89.	Mr. Stephen Waithaka	Sub-county agricultural engineer: the ministry of agriculture – Murang'a
90.	KWS warden – Embu	
91.	Mr. Stanley Marioku	KFS officer
92.	Mr. Bashir	NEMA office, Meru County
93.	Mr. Winsume Ouna	KWS Research Scientist
94.	Mr. Franklin Kinyua	Secretary, Mugumayo Irrigation Project
95.	Mr. Martin Mugendi	Secretary, Munga Kiriani Multi-purpose Cooperative

NO.	Name	Designation
		Society
96.	Mr. Alphonse Murungi	Chairman Munga Kiriani Multi-purpose Cooperative Society
97.	Mr. Peterson Kirimi	Chairman, Mugumayo Irrigation Project
98.	Ms. Ann Kendi	Mugumayo Irrigation Project
99.	Ms. Charity Kiraitu	District agricultural officer – Imenti
100.	Ms. Anne Githaiga	District education officer – Imenti
101.	Ms. Peter Mureithi	Irrigation officer – Meru
102.	Mr. Alex	Director – Caritas, Meru
103.	Mr. Stephene Mithika	Water technician: Catholic Diocese of Meru
104.	Mr. Mutea Rukuaru	County director of social development – Meru
105.	Mr. Nabea	County Irrigation Coordinator – Meru
106.	Mr. Kamau	County Irrigation Offices – Meru
107.	Ms. Patricia Mokua	County director-NEMA – Tharaka Nithi County
108.	Mr. Mbuga Andiel	Sub-County Livestock marketing officer – Chuka
109.	Mr. Christopher Muchiri	Counnty director-NEMA – Embu
110.	Mr. Stephen Kiriamburi	Monitoring and evaluation officer (livestock) – Embu
111.	Ms. Grace Njoki	Sub-county livestock officer – Muranga'a
112.	Mr. Mugo	KFS Meru
113.	Ms. Zipporah Matombe	Chairlady , MEFPEC CFA
114.	Ms. Elizabeth Kiogora	Chairlady, Lower Imetni CFA
115.		Eco-system Conservator Nyeri

NO.	Name	Designation
	Mr. Mathenji	
116.	Mr. Kamau	Deputy Eco-system Conservator Nyeri
117.	Mr. John Kanyi	Chairman, Zuti CFA
118.	Mr. Robert Muchemi	Forester, Zuti Forest Station
119.	Mr. Musembi	Forester, Castle Forest Station
120.	Mr. Kariuki Miano	Chairman, Castle CFA
121.	Mr. A. M. Anampiu	County Director, Agriculture, Nyeri
122.	Mr. Theuri	County Director, Livestock, Nyeri
123.	Mr. Ole Pussy	County Director, Social Services, Nyeri
124.	Mr. Njoka	County Director, Environment, Nyeri
125.	Mr. J. M. Gitonga	Ecosystem Conservator, Muranga
126.	Mr. David Njenga	Assistant Ecosystem Conservator, Kirinyaga
127.	Mr. Nderitu	Assistant Ecosystem Conservator, Muranga
128.	Ms. Veronica Maina	NEMA office, Muranga
129.	Mr. Phares Njogu	Chairman, Ragati WRUA
130.	Mr. Ruthuki	Ag. County Director of Water, Nyeri
131.	Mr. Samuel Nyaga	NEMA office, Kirinyaga
132.	Mr. Mark Murimi	NEMA office, Kirinyaga

APPENDIX 4: BASELINE SURVEY VALIDATION WORKSHOP REPORT

The Baseline survey validation workshop was held in Kaguru Farmers Training Center in Nkubu on the 10th June 2014. The workshop was facilitated by the UTaNRMP Project Coordinating Team.

The survey was carried out in the24 River Basins and 4 Tributaries of MKEPP river basins within Upper Tana catchment in Muranga, Nyeri, Kerugoya, Embu, Meru, and Tharaka Nithi Counties. The objective of the survey was to generate baseline data that will help in assessing the situation at the start of the project implementation, set bench marks/indicators to inform the M&E function of the project and form a platform for assessing the outcomes and impact of the project. The survey is expected to provide comprehensive information for planning and decision-making besides providing benchmarks against which programme interventions will be assessed.

The workshop was attended by 65 participants (49 men and 16 Women) composed of the PSC members, PCT, CPCs, County Technical Officers and community representatives (WRUAs and CFAs).

The workshop started with a word of prayer by Ms. Teresia Ngatia which was followed by self-introduction by the participants.

Opening remarks

In her opening remarks, the Project Coordinator,Ms Muthoni Livingstone,thanked all participants for attending the workshop whose objective was to review and validate the project baseline survey report. The PC noted that the project had hired a consultant to carry out the baseline survey to establish the situation at the start of the project implementation. The consultant went round collecting information through interviews and some of us were interviewed and the reason for the workshop is to validate the information collected and give feedback in order to add value to the report.

The PC also commended participants and reminded them that they had been invited on the basis of the roles they played during the survey and their ability, hence they should assess the linkages between the presentations by the consultant, what is on the ground and the reality, because the final report which will incorporate their comments will remain with the project for many years to come. Having read the draft report, the PC requested all participants to listen to the presentation and critically analyse and add value to the report.

Presentation

Mr. Mbiri Gikonyo, from Kamfor who was the team leader invited the team of consultants to introduce themselves. The consultant started by highlighting the importance of baseline data where they noted that the baseline data helps to: Set M&E benchmarks, set base for measuring impacts, align and focus/target project interventions and assessing the situation on the ground before the commencement of key intervention activities.

The presentations were made on the importance of baseline survey, methodology, socio-economics, Water, Environment, Rural Livelihoods, and Project Coordination and Management.

The chair of the session on Methodology was, Mr. S. Mwavali, PSC Member, Ministry of Devolution and Planning. Key comments raised in the session were:-

1. There is need to review the methodology of the study because it isthe basis for study
2. The chair sought clarity on what was the number of respondents as the report indicated 895 and 898. In some areas it was noted that there were more questionnaires administered than others.

- It was explained that the typographical error will be reviewed and amended. In addition it was explained that the initial number of respondents was 576, for 12 river basins but upon the end of the survey, the client requested the study team to include additional 12 rivers, hence the sample increased to 864.

3. The team was requested to explain how FGDs and Key Informants Interviews were conducted in the report and whether questionnaire pretesting was done. The team leader explained that the questionnaire pretesting was conducted in Mid-Thika river basin on the 14th March prior to commencement of field visits on the 17th March 2014.
4. A participant wanted to know whether there was any relation between PRAs and Baseline Survey information, but they were informed there was none. Participants were also informed there were bigger samples from the middle section of the rivers due to high population in those sections of river basins.
5. Participants sought to know how interviews were conducted and whether there was any bias. They were informed that the interviews were done using random sampling, a factor which was supported by various WRUA members during the workshop.
6. The study team was requested to do a triangulation of data, prepare list of people met, and contacted, and the area.

Comments on Socio-Economic Issues

The participants sought clarification on the following issues:

1. Whether the devolution has changed the situation on the ground in terms of doctors per county? The number of doctors, as reported, is it both private and government hospitals?
2. What are the implications of the facts on the project?: The participants were informed that even though the study findings indicate that the number of households is 6 rather than 5 as indicated in the initial project planning, it will not affect the implementation of the project.
3. The consultant was requested to provide information on the numbers of WRUAS, CFAsin the river basins, and number of Common Interest Groups, how many are associated with disabilities, and what activities they are involved in.
4. The consultant was requested to expound on Education levels and other education indicators, what are the reasons and effects of the findings, (Remittances, effects) and implications to the implication of the project activities.
5. Provide information on Miraa issues, socio effects of Miraa, child labour and education. Any relationship between education indicators in relation to Miraa growing area?
6. Include the number of education institutions in Meru and their ratios

7. Recommendations on how to mitigate on poverty in the areas. Which groups contribute most to poverty and linkages to crime?
8. Explore the reasons why Meru has low numbers of families with title deeds
9. Energy- Average access to Electricity per county and compare with national average
10. The consultant was advised to distinguish between wood fuel and firewood
11. It was noted that pastoralism as an economic activity for lower zones of Embu County.
12. Access to water- Compare the findings with the findings with the other consultants
13. Farmers working on own farms are fewer in Mathioya, the consultant was advised to explore how this will affect the project, where there are more workers than owners.
14. It was noted that some communities were omitted in the report. The consultant was advised to include other communities in Kirinyaga county such the Ndia and **Gichugu,**
15. Explain why the awareness of CFAs is higher in some areas than others.
16. Compare statistics with the national statistics
17. In Table 3.6, the consultant was advised to separate machinery from sources of labour
18. Introduce a column on table 3.1 on land size

Comments on Agriculture livelihoods

1. Organize the presentation of data to ensure a good flow and keen following of the TOR
2. Give amounts of production in quantities per river basin and if possible per county and possibly identify the indicators justifying the figures to allow for identification of measurable intervention measures for instance if the production of a certain product is low in some parts give the possible reasons and align these with the recommendations so the project has clear points of intervention
3. Check on the contribution of livestock production in the recent IGAD Report. It indicates that the figures have significantly increased
4. Elaborate more on the adoption of what we call new technologies especially on what percentages mean (if possible use a different types as opposed to new technologies). Also try to find reasons on levels of uptake since others are down and others significant and also align it with recommendations on what the project can do to improve these sectors
5. It is important to explain percentages for instance n% should always be explained against the numbers and in line with the methodology (sample and justification)
6. Indicate the report that was used in description of soil types and fertility
7. Always present findings within parameters that are easy to measure and as such easy to monitor
8. Explain charts and if possible have more tables in the presentation of data since they help in comparison of data and clear illustration of findings
9. Put agro forestry into consideration, it appears to be left out
10. There is some mix up in table no. 6.5
11. It is good to seek data on some initiatives for instance on charcoal production. It was reported that in Meru County there are so far two registered groups for charcoal production in Meru County
12. Recommend practical measures to curb human-wildlife conflicts for instance it is not enough to recommend fencing since other animals like monkeys and baboons might not be deterred with fences (may look at the best ways of coexisting with these animals) also if possible tone down the statement that communities kill animals when

they invade the farms, although it came from them the statement is too harsh and has serious implications)

13. Mention of carbon credit is lacking in the report but is was pointed out that there is a biomass survey that will be conducted soon and it will tackle this issue so it was agreed that at least the baseline should indicate that the project intends to carry out this survey
14. It is important to indicate the areas in which the ministry of environment is working on in regard to green economy
15. Identify potentials for instance potential areas for agriculture, for uptake of various technologies, for scale up etc.
16. The table on fish production and food storage is mixed up since it indicates granaries instead of indicating the fish storage facilities
17. Tackle the area of food security i.e. according to findings what areas either per river basin were identified as being food insecure why and tie this with a recommendation on what can be done

Comments on Management and Coordination

1. What institutions exist in the project area
2. The report does not show any findings from the literature review
3. What are the coordination aspects at the institutional level
4. Why is participation weak- Is it because of preparation, is it among all the members (what are the dimensions of participation in projects)
5. Sustainability is weak- But the community has been implementing their projects.
6. Look at the magnitude of the project vis a vis the capacity of the community members/groups
7. Component given a raw deal- No background project information, what constitutes Project Management
8. Section does not give us any findings statistically proven. Information will not give much information by the project
9. Most projects are not donor driven
10. Which groups have been donor funded
11. Contradictions on the levels of literacy
12. This section is not about financial, give issues on banking,
13. Participatory project planning was there evidence that community is not involved, same for sustainability.
14. How useful will the accounting system be to illiterate members of the groups
15. There is need to come out clearly and emphasize on coordination aspects. How will the funds be accounted for, value for money into the community
16. We have moved away from donor driven projects to community owned.
17. Project management and coordination should be at the institutional level, It should capture the role of each agencies and how they interrelate. This role is not seen in the documents
18. What is the role of devolved units

Other comments:

- Technical officers should encourage community to elect literate officers
- Community initiatives are lacking.
- Talk more about coordination structures e,g. county facilitation teams, Role of the county, sub counties,

- What are the challenges and what are the recommendations, what is recommended in the PDR and what your view about this is.

The meeting ended at 5pm, and the team leader from Kamfor Company assured all the participants that the comments and questions raised during were very useful, and will be incorporated in the final report. The meeting was finally closed with a vote of thanks from the Project Coordinator, who ensured that every participant who had not made any input into the workshop discussions does so. This was to ensure that every participant contributes to the proceeding to enhance ownership of the report.

LIST OF VALIDATION WORKSHOP PARTICIPANTS ON BASELINE SURVEY FORUPPER TANA NATURAL RESOURC E MANAGEMENT PROJECT HELD IN KAGURU, NKUBU

No.	Name	Designation	ORGANIZATION	Workstation	County
1	Mathew Murgor	SECO	KenGen	Nairobi	Nairobi
2	Henry Ngeno	SADLP	MoALF, SDL	Nairobi	Nairobi
3	Benedict Omondi	PSC	KFS	Nairobi	Nairobi
4	Francis Koome, Simon	WRC	UTaNRMP	Embu	Embu
5	Samwel Obwocha	PO	UTaNRMP	Embu	Embu
6	Paul njunguna	LEC	UTaNRMP	Embu	Embu
7	Rodgers Musyoka	APA	UTaNRMP	Embu	Embu
8	Simon Mombere	KMLO	UTaNRMP	Embu	Embu
9	Samwel Onyango	PFC	UTaNRMP	Embu	Embu
10	I saac Mugura	CEC	UTANRMP	Embu	Embu
11	P.G Njue	Driver	UTaNRMP	Embu	Embu
12	S.K Ngaari	AIC	UTaNRMP	Embu	Embu
13	George Karumba	Driver	UTaNRMP	Embu	Embu
14	James Kibathi K	SNR Super	ALRI	Mbeere North	Embu
15	Lincoln N Kiura	C/MAN KWRUA	KAPINGAZI WRUA	Embu west	Embu
16	Lilian Olunga	DSDO	SOCIAL DEV	Embu west	Embu
17	Murimi nyaga	CDU	LIVESTOCK	Embu	Embu
18	Jacob. N.Nyaga	SSDO	SOCIAL DEV	Embu	Embu.
19	Francis . N . Njiru	119OR	WATER	Mbeere	Embu
20	Winfred .W .Njeru	c/lady	NGOROKA W.G	Embu	Embu
21	Anne N Kimotho	PRINCIPAL FISHERIES OFFICER	FISHERIES DEPARTMENT	Kirinyaga	Kirinyaga
22	Nicholas N	CPC	WATER	Kirinyaga	Kirinyaga
23	Benard kingoruse		WRMA	Kirinyaga	Kirinyaga
24	Andrew t mwaura	PSDO	S. DEV	Kirinyaga	Kirinyaga
25	Pauline kibiru	SSW	WATER	Kirinyaga central	Kirinyaga
26	Joseph Muriuki N	MUGAKA WRUA	WRUA	Kerugoya in Kirinyaga	Kirinyaga

No.	Name	Designation	ORGANIZATION	Workstation	County
		CHAIRMAN			
27	Jamleck M Ngeera	SENIOUR FORESTER	KFS	Kathandeini Mt Kenya	Kirinyaga
28	Michael Munyiri	WRO	WRM	Kerugoya	Kirinyaga
29	Humphrey kimathi	CHAIRMAN	NITHI WRUA	Nithi	T. Nithi
30	Ceasar Njiru	ENG 2 AGRIC	MOA L&F	T.Nithi HQ	T . Nithi
31	Stephen G Gichunge	COUNTY DIRECTOR OF FISHERIES	FISHERIES	T .Nithi	T . Nithi
32	Japheth kithumbi	CHAIRMAN	CFA	T . Nithi	T .Nithi
33	John G Kamau	CPC	WATER	Chuka T. Nithi	T. Nithi
34	Jane Kawira	LECTURE 1	KFS	Chuka	T.Nithi
35	Oyaro nyambosu	SNR R	KFC	Meru	Meru
36	Phylis Mbijiwe	DCDCD	ALF	Meru	Meru
37	Mutea Rukwara	ADSD	MLSSS	Imenti North	Meru
38	Samuel Ninabea	CPC	UTaNRMP	Meru	Meru
39	Sammy Muriuki	CHAIRMAN	UT.WRUA	Meru	Meru
40	Mukuria Gabriel	CDPO	MOPD	Meru	Meru
41	Zipporah Matuwisi	CHAIRPERSON	MEFECAP	Meru	Meru
42	Josephat M Gathuo	C/MAN CFA WANJERERE	CFA	WANJERE FOREST	Muranga
43	Joseph . K. Nyamu	C/MAN SABAWRUA	SABAWRUA	Sabasaba River basin	Muranga
44	Stephen Mugo	CDSD	SOCIAL DEV	Muranga	Muranga
45	Mbogo BN	CFC	UTANRMP	Muranga	Muranga
46	Kathini Mithau	CDO	WRMA	Muranga	Muranga
47	Stephen M Waitheki	SCAE	AGRIC	Muranga	Muranga
48	Celline N Obwora	SUB COUNTY DEV OFFICER	MIN OF DEV & PLANNING	Muranga	Muranga
49	Joseph M Munyiri	PFO	FISHERIES	Muranga	Muranga
50	Joseph A Imboba	DCDA	MOA	Nyeri	Nyeri
51	Stanley M Mutuota	CDIRRIG	IRRIGATION	Nyeri	Nyeri
52	RM Kiragu	CD LIVESTOCK	MOA	Nyeri	Nyeri

No.	Name	Designation	ORGANIZATION	Workstation	County
		PRODUCTION			
53	E.M Ole Pussy	A.A.S.D	MOA	Nyeri	Nyeri
54	M.W Ndegwa	S.F.O	K.F.S	Nyeri	Nyeri
55	Loise Ndegwa	SECRETARY	CFA	Nyeri	Nyeri
56	Teresa Ngatia	REP CDPO	DEVOLUTION & PLANNING	Nyeri	Nyeri
57	Joseph M Lawrence	CPC	UTANRMP	Nyeri	Nyeri
58	Martin Kamuri	SECRETARY	RWUA	Nyeri	Nyeri
59	Mbiri Gikonyo	CONSULTANT	KAMFOR	Nairobi	Nairobi
60	Nicholas Bunyige	CONSULTANT	KAMFOR	Nairobi	Nairobi
62	Simeon Njuguna	CONSULTANT	KAMFOR	Nairobi	Nairobi
63	David M Kioko	CONSULTANT	KAMFOR	Nairobi	Nairobi
64	Magara S Ibrahim	CONSULTANT	KAMFOR	Nairobi	Nairobi
65	Munene Kiura	CONSULTANT	KAMFOR	Nairobi	Nairobi

APPENDIX 5: GEO-REFERENCES

RIVER BASIN	FEATURE	Place	Lattitude	Longitude	Eastings	Northings
Maara River Basin	Dam	Water storage at Irindiro	00 09.122	037 52.704	375186.00	9983192.00
Maara River Basin	Dam	Water Storage Tank at Kagaini Tea Buying Centre	00 15.717	037 38.213	348306.00	9971038.00
Maara River Basin	Spring	Karia Spring	00 15.791	037 38.366	348590.00	9970902.00
Maara River Basin	Wetland	Kiagamboli Village	00 15.862	037 38.366	348590.00	9970771.00
Maara River Basin	Dam	Water storage at Weru	00 16.053	037 37.954	347826.00	9970419.00
Maara River Basin	Erosion Spot	Gulley Erosion	00 16.099	037 37.980	347874.00	9970334.00
Maara River Basin	Spring		00 16.116	037 37.769	347482.00	9970303.00
Maara River Basin	Dam	Water storage for 4K water project	00 16.206	037 38.987	349742.00	9970137.00
Mathioya Middle River Basin	Erosion Spot	Gulley erosion	00 64.103	037 04.942	286612.00	9881844.00
Mathioya Middle River Basin	Wetland	Kenugu	00 64.948	037 08.248	292746.00	9880291.00
Mathioya Middle River Basin	Quary	Quarry	00 65.023	037 08.248	292746.00	9880152.00
Mathioya Middle River Basin	Spring	Gaturi	00 65.411	037 09.977	295954.00	9879439.00
Mathioya Middle River Basin	Erosion Spot	Gulley	00 65.425	037 009.863	295743.00	9879413.00
Mathioya Middle River Basin	Wetland	Gaturi	00 65.438	037 10.089	296162.00	9879390.00

Mathioya Middle River Basin	Wetland	Gathairo	00 65.601	037 10.338	296624.00	9879089.00
Murubara River Basin	Spring	Gacore village	00 28.152	037 22.237	318671.00	9948118.00
Murubara River Basin	Wetland	Gacore Village	00 28.199	037 22.131	318475.00	9948031.00
Murubara River Basin	Spring	Kariru	00 28.682	037 21.764	317794	9947141
Murubara River Basin	Spring	Kavoe village	00 28.702	037 21.831	317918.00	9947104.00
Murubara River Basin	Dam	Wang'uru (NIP)	00 40.770	037 22.119	318459	9924864.00
Murubara River Basin	Sewage	Sewage at Wang'uru	00 41.186	037 22.272	318743.00	9924097.00
Murubara River Basin	Borehole	Borehole at Mikimaini	00 41.542	037 23.414	320862.00	9923442.00
Murubara River Basin	Spring	Gatoe	00 28.305	037 22.133	318478.00	9947836.00
Ragati River Basin	Spring	Ihwagi village	00 26.842	037 08.436	293065.00	9950526.00
Ragati River Basin	Spring	Gitaga spring	00 33.912	037 11.472	298701.00	9937497.00
Ragati River Basin	Erosion Spot	Gulley soil erosion (Kabingoti)	00 33.920	037 11.446	298653.00	9937482.00
Ragati River Basin	Wetland	Gitaga village	00 34.008	037 11.497	298748.00	9937320.00
Ragati River Basin	Wetland	Gatithi village	00 34.753	037 11.235	298262.00	9935946.00
Ragati River Basin	Quary	Shamrock Quarry	00 35.258	037 11.521	298793.00	9935016.00
Ragati River Basin	River Confluence	River Ragati joins RiverTana	00 39.832	037 11.840	299388.00	9926586.00
Ragati River Basin	Erosion Spot	Gulley erosion at Mururiini	00 34.891	037 11.446	299385.00	9935692
Rupingazi River Basin	Water Intake	Kirinyaga intake Project	00 25.745	037 27.562	328550.00	9952556.00
Rupingazi River Basin	Spring	Karatee	00 25.783	037 27.481	328399.00	9952486.00
Rupingazi River Basin	Spring	Kuvurukori	00 26.175	037 27.519	328470.00	9951763.00
Rupingazi River Basin	Dam	EWASCO Water Project	00 27.819	037 27.233	327940.00	9948733.00

Rupingazi River Basin	Spring	Gathita	00 29.038	037 26.946	327408.00	9946487.00
Rupingazi River Basin	Wetland	Nthambo	00 29.525	037 26.359	326319.00	9945589.00
Thangatha River Basin	Spring	Ganguthi	N 00 07.687	E 037 53.526	329197.00	9918180.00
Thangatha River Basin	Wetland	Gathasa	N 00 07.718	E 037 53.375	376430.00	9985779.00
Thangatha River Basin	Spring	Gathima	N 00 07.732	E 037 53.376	376432.00	9985753.00
Thangatha River Basin	Spring	Kethare	N 00 07.854	E 037 53.204	376113.00	9985528.00
Thangatha River Basin	Erosion Spot	Gulley at Gikuri	N 00 08.845	E 037 52.715	375206.00	9983702.00
Thiba River Basin	Watering Point	Githoboto (cattle drinking water area	00 43.276	037 27.767	328939.00	9920249.00
Thiba River Basin	Erosion Spot	Githoboto (gulley erosion)	00 43.289	037 27.792	328985.00	9920225.00
Thiba River Basin	Dam	Makindu	00 44.399	037 27.906	329197.00	9918180
Upper Mariara River Basin	Water Intake	Intake	00 01.754	037 62.920	394135.00	9996768.00
Upper Mariara River Basin	Water Intake	Intake	00 01.762	037 63.033	394345.00	9996753.00
Upper Mariara River Basin	Wetland	Mariene	00 01.796	037 62.824	393957.00	9996691.00
Upper Mariara River Basin	Water Intake	Intake	00 01.870	037 62.1137	392639.00	9996554.00
Upper Mariara River	Wetland	Angara	00 01.872	037 62.269	392928.00	9996550.00

Basin						
Upper Mariara River Basin	Spring	Mariene	00 01.879	037 62.721	393766.00	9996538.00
Upper Mariara River Basin	Water Intake	Intake(ABO central water project)	00 01.904	037 62.648	393631.00	9996492.00
Upper Mariara River Basin	Wetland	Tambanjuku	00 01.919	037 62.020	392466.00	9996464.00
Upper Mariara River Basin	Spring	Tambanjuku	00 01.962	037 62.034	392492	9996385.00
Upper Mariara River Basin	Wetland		00 01. 860	037 62.782	393880.00	9971749.00
Upper Ura River Basin	Dam	Muone water project	00 21.261	037 92.841	449631.00	9960832.00
Upper Ura River Basin	Spring	Muamba spring	00 21.796	037 92.070	448201.00	9959846.00
Upper Ura River Basin	Spring	Muura Spring	00 22.104	037 92.540	449073.00	9959279.00
Bwathonaro River Basin	Spring	Gethanja	00 15.902	037 56.929		
Bwathonaro River Basin	Dam	Mukurio	00 25.373	037 83.868		
Bwathonaro River Basin	Bridge	Mukuirio bridge	00 25.400	037 83.880		
Bwathonaro River Basin	Wetland	Gethanja	00 26.491	037 94.869		
Bwathonaro River Basin	River	River Bwathanaro	00 15.687	037 56.310		
Ena-Thura Water Basin	Quary	Kageeri Quary	00 33.687	037 38.688	349193.00	9937925.00
Ena-Thura Water Basin	Quary	Thura River Sand Harvesting Zone	00 37.549	037 39.809	351274.00	9930809.00
Ena-Thura Water Basin	Borehole	Kamogo Borehole near Thura bridge	00 37.694	037 39.900	351443	9930542.00
Ena-Thura Water Basin	River Bank	Thura Collapsed River Bank	00 38.024	037 39.975	351582.00	9929934.00
Kenyaritha River Basin	Wetland	Nguru	00 06.028	037 42.046	355415.00	9988892.00

Kenyaritha River Basin	Wetland	Nguru	00 06.076	037 42.208	355716.00	9988804.00
Kenyaritha River Basin	Wetland	Kibukona	00 06.288	037 42.256	355805.00	9988413.00
Kenyaritha River Basin	Spring		00 06.467	037 42.279	355847.00	9988083.00
Kenyaritha River Basin	Spring		00 06.049	037 42.112	355538.00	9988853.00
Kenyaritha River Basin	Wetland	Kibukona	00 06.510	037 42.193	355688.00	9988004.00
Kenyaritha River Basin	Wetland	Kenyaritha(not protected it is within public land –national park	00 07.008	037 42.049	355421.00	9987086.00
Kenyaritha River Basin	Wetland	Ithuru	00 05.984	037 41.922	355185.00	9988973.00
Lower Kayahwe River Basin	Wetland	Maragua road	00 74.798	037 00.720	278792.00	9862125.00
Lower Kayahwe River Basin	Dam	Kandigenye	00 74.882	037 00.021	278792	9861970.00
Lower Kayahwe River Basin	Spring	Kanginga	00 74.906	037 00.042	277535.00	9861925.00
Lower Kayahwe River Basin	Wetland	Kanginga	00 74.916	037 00.021	277496.00	9861907.00
Lower Kayahwe River Basin	Spring	Gathina	00 75.150	037 02.438	281980.00	9861479.00
Lower Maara River Basin	River Confluence	Maara Rivers Joining Point	00 27.143	037 66.559	400888.00	9949991.00
Lower Maara River Basin	Erosion Spot	Gulley Erosion	00 27.600	037 78.252	422575.00	9949152.00
Lower Maara River Basin	Dam	KIWASCO water storage tank	00 57.842	037 24.314	322544.00	9893403.00
Lower Maara River Basin	Wetland	Kimaitha	00 59.146	037 24.482	322857.00	9891000.00

Lower Maara River Basin	Spring	Kiandangae	00 67.026	037 20.568	315604.00	9876474.00
Lower Maara River Basin	Wetland	Thumaita	00 58.931	037 24.540	322964.00	9891396.00

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
1.	Amboni/Muringato	Lower	-0.358741	36.96189
2.	Amboni/Muringato	Lower	-0.3728021	36.87169
3.	Amboni/Muringato	Lower	-0.3766278	36.88233
4.	Amboni/Muringato	Lower	-0.484211	36.94341
5.	Amboni/Muringato	Lower	-0.3609467	36.95418
6.	Amboni/Muringato	Lower	-0.4765868	36.91563
7.	Amboni/Muringato	Upper	9963839	262612
8.	Amboni/Muringato	Upper	9963839	262612
9.	Amboni/Muringato	Upper	-0.33786881	36.87308
10.	Amboni/Muringato	Upper	-0.33815364	36.873694
11.	Amboni/Muringato	Upper	-0.33829852	36.873103
12.	Amboni/Muringato	Upper	-0.33759164	36.872818
13.	Amboni/Muringato	Middle	-0.38210357	36.935818
14.	Amboni/Muringato	Middle	-0.38282904	36.936137
15.	Amboni/Muringato	Middle	-0.38271204	36.936006
16.	Amboni/Muringato	Middle	-0.38293652	36.936433
17.	Amboni/Muringato	Middle	-0.38222641	36.936718
18.	Amboni/Muringato	Middle	-0.38189316	36.93586
19.	Amboni/Muringato	Middle	-0.38210998	36.936529
20.	Amboni/Muringato	Middle	-0.38215054	36.936054
21.	Amboni/Muringato	Middle	-0.38176591	36.937201
22.	Amboni/Muringato	Middle	-0.38247084	36.93625
23.	Amboni/Muringato	Middle	-0.38266359	36.936289
24.	Amboni/Muringato	Middle	-0.38254657	36.936685
25.	Chania	Upper	-0.72983	36.6653
26.	Chania	Upper	-0.76756	36.64929
27.	Chania	Upper	-0.7715945	36.68008
28.	Chania	Upper	-0.7512738	36.6843
29.	Chania	Upper	-0.7506246	36.67161
30.	Chania	Upper	-0.7630732	36.68894
31.	Chania	Middle	-0.7336746	36.66776
32.	Chania	Middle	-0.7418592	36.65893
33.	Chania	Middle	-0.7269783	36.66938
34.	Chania	Middle	-0.7689458	36.68277
35.	Chania	Middle	-0.7621787	36.6638
36.	Chania	Middle	-0.750777	36.68387
37.	Chania	Middle	-1.0331955	37.04979
38.	Chania	Middle	-1.0169958	37.06636
39.	Chania	Middle	-1.0194783	37.04601
40.	Chania	Middle	-1.0222701	37.04608
41.	Chania	Middle	-1.0350064	37.04784
42.	Chania	Middle	-1.0129678	37.05804
43.	Chania	Lower	-1.0161946	37.0566
44.	Chania	Lower	-1.0328731	37.06503
45.	Chania	Lower	-1.0236427	37.06544
46.	Chania	Lower	-1.0137709	37.05525
47.	Chania	Lower	-1.016234	37.05054
48.	Chania	Lower	-1.0235914	37.05225
49.	Ena Tributaries	Lower	351639	9930558
50.	Ena Tributaries	Lower	352096	9930028
51.	Ena Tributaries	Lower	350942	9930057
52.	Ena Tributaries	Lower	351947	9929903

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
53.	Ena Tributaries	Lower	351855	9930020
54.	Ena Tributaries	Lower	350758	9930671
55.	Ena Tributaries	Lower	351120	9929930
56.	Ena Tributaries	Lower	350949	9930475
57.	Ena Tributaries	Lower	352092	9930490
58.	Ena Tributaries	Middle	351782	9931128
59.	Ena Tributaries	Middle	-0.50107891	37.640688
60.	Ena Tributaries	Middle	-0.49925608	37.642402
61.	Ena Tributaries	Middle	-0.50187113	37.646613
62.	Ena Tributaries	Middle	-0.50058963	37.640848
63.	Ena Tributaries	Middle	-0.50052811	37.642298
64.	Ena Tributaries	Middle	-0.50147436	37.640531
65.	Ena Tributaries	Middle	-0.50484472	37.640699
66.	Ena Tributaries	middle	-0.50428956	37.642656
67.	Ena Tributaries	middle	-0.50147436	37.642612
68.	Ena Tributaries	middle	-0.50052811	37.646613
69.	Ena Tributaries	middle	-0.50107891	37.640699
70.	Ena Tributaries	middle	-0.50428956	37.642402
71.	Ena Tributaries	Middle	-0.49989566	37.642656
72.	Ena Tributaries	Middle	-0.50396558	37.642612
73.	Ena Tributaries	Middle	-0.49933582	37.639622
74.	Ena Tributaries	Middle	-0.49756481	37.644259
75.	Ena Tributaries	Middle	-0.50428956	37.645997
76.	Ena Tributaries	Upper	-0.5072221	37.65448
77.	Ena Tributaries	Upper	0.49341928	37.64745
78.	Ena Tributaries	Upper	-0.50184645	37.65314
79.	Ena Tributaries	Upper	-0.51125539	37.64468
80.	Ena Tributaries	Upper	-0.49910564	37.65423
81.	Ena Tributaries	Upper	-0.4919602	37.64973
82.	Ena Tributaries	Upper	-0.49351934	37.64659
83.	Ena Tributaries	Upper	-0.50896478	37.65377
84.	Ena Tributaries	Upper	-0.49465211	37.64125
85.	Iraru	Middle	357539	9981146
86.	Iraru	Middle	357176	9981607
87.	Iraru	Lower	357274	9981550
88.	Iraru	Lower	-0.3371811	37.849852
89.	Iraru	Lower	-0.32612705	37.834569
90.	Iraru	Lower	-0.32352454	37.844155
91.	Iraru	Lower	-0.3389728	37.840495
92.	Iraru	Lower	-0.32589082	37.855067
93.	Iraru	Lower	-0.32181374	37.84162
94.	Iraru	Lower	-0.33958194	37.8456
95.	Iraru	Lower	-0.34068281	37.840228
96.	Iraru	Middle	-0.33659619	37.846962
97.	Iraru	Upper	-0.15057842	37.667226
98.	Iraru	Upper	-0.14983718	37.666449
99.	Iraru	Upper	-0.15007642	37.667729
100.	Iraru	Upper	-0.15039405	37.666155
101.	Iraru	Upper	-0.15018537	37.666753
102.	Iraru	Upper	-0.15055423	37.667358
103.	Iraru	Upper	-0.15053682	37.667704
104.	Iraru	Upper	-0.14995271	37.666329
105.	Iraru	Upper	-0.15017103	37.666925

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
106.	Iraru	Middle	-0.15029295	37.666708
107.	Iraru	Middle	-0.15116865	37.667156
108.	Iraru	Middle	-0.15049717	37.66662
109.	Iraru	Middle	-0.15891227	37.702399
110.	Iraru	Middle	-0.16106332	37.702652
111.	Iraru	Middle	-0.15764967	37.703299
112.	Iraru	Middle	-0.15710695	37.707309
113.	Iraru	Middle	-0.15529147	37.706646
114.	Iraru	Middle	-0.15709952	37.709726
115.	Iraru	Middle	-0.16223311	37.708182
116.	Iraru	Middle	-0.1555344	37.705467
117.	Iraru	Middle	-0.15995403	37.706716
118.	Iraru	Middle	-0.15682232	37.705866
119.	Iraru	Middle	-0.15694556	37.70384
120.	Iraru	Middle	-0.15572288	37.707244
121.	Kapingazi Tributaries	lower	0.45869	37.39178
122.	Kapingazi Tributaries	lower	-0.47518999	37.39722
123.	Kapingazi Tributaries	lower	-0.46514105	37.3903
124.	Kapingazi Tributaries	lower	-0.47503983	37.39801
125.	Kapingazi Tributaries	lower	-0.4647641	37.38658
126.	Kapingazi Tributaries	lower	-0.46547356	37.39126
127.	Kapingazi Tributaries	Lower	325281	9949667
128.	Kapingazi Tributaries	Lower	325340	9949957
129.	Kapingazi Tributaries	Lower	325705	9949793
130.	Kapingazi Tributaries	Upper	-0.38166	37.46621
131.	Kapingazi Tributaries	Upper	-0.37984	37.46103
132.	Kapingazi Tributaries	Upper	-0.3916	37.45707
133.	Kapingazi Tributaries	Upper	-0.38878333	37.46066
134.	Kapingazi Tributaries	Upper	-0.38384583	37.46775
135.	Kapingazi Tributaries	Upper	-0.38511826	37.45306
136.	Kapingazi Tributaries	Upper	-0.38460265	37.46189
137.	Kapingazi Tributaries	Upper	-0.39013675	37.45855
138.	Kapingazi Tributaries	Upper	-0.38910038	37.45694
139.	Kapingazi Tributaries	Middle	-0.38915336	37.4635
140.	Kapingazi Tributaries	Middle	-0.38674561	37.4576
141.	Kapingazi Tributaries	Middle	-0.39092674	37.46693
142.	Kapingazi Tributaries	Middle	-0.3854794	37.45731
143.	Kapingazi Tributaries	Middle	-0.38859719	37.46411
144.	Kapingazi Tributaries	Middle	-0.37847818	37.46628
145.	Kapingazi Tributaries	Middle	-0.39400456	37.46188
146.	Kapingazi Tributaries	Middle	-0.37911882	37.46412
147.	Kapingazi Tributaries	Middle	-0.3847358	37.46764
148.	Kapingazi Tributaries	Middle	-0.39010038	37.45858
149.	Kapingazi Tributaries	Middle	-0.39134978	37.4622
150.	Kapingazi Tributaries	Middle	-0.38244329	37.46282
151.	Kapingazi Tributaries	Middle	-0.38855323	37.45937
152.	Kathita Tributaries	Upper	37N0352022	UTM0010354
153.	Kathita Tributaries	Upper	37NB52 421	UTM 5009484
154.	Kathita Tributaries	Upper	37N 0352143	UTM0010186
155.	Kathita Tributaries	Upper	37N 0353682	VIM 009930
156.	Kathita Tributaries	Upper	0.00310434	37.575047
157.	Kathita Tributaries	Upper	0.00059464	37.576924
158.	Kathita Tributaries	Upper	0.00138879	37.58023

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
159.	Kathita Tributaries	Upper	-0.00038789	37.58203
160.	Kathita Tributaries	Upper	0.00082535	37.577139
161.	Kathita Tributaries	Middle	NOO 05670	E037 41-969
162.	Kathita Tributaries	Middle	NOO 06 649	E037 42. 080
163.	Kathita Tributaries	Middle	NOO 06. 806	62037 41. 952
164.	Kathita Tributaries	Middle	NOO 05. 772	E037 41. 937
165.	Kathita Tributaries	Middle	NOO 06. 343	E037 42. 295
166.	Kathita Tributaries	Middle	NOO 06 491	E037 42. 251
167.	Kathita Tributaries	Middle	NOO 06. 487	E0370 42. 321
168.	Kathita Tributaries	Middle	NOO 06 . 542	E037 42. 193
169.	Kathita Tributaries	Middle	0.06681858	37.779192
170.	Kathita Tributaries	Middle	0.08055619	37.770228
171.	Kathita Tributaries	Middle	0.06641789	37.772114
172.	Kathita Tributaries	Middle	0.0745689	37.780874
173.	Kathita Tributaries	Middle	0.08104184	37.770426
174.	Kathita Tributaries	Middle	0.07026455	37.775399
175.	Kathita Tributaries	Middle	0.07741296	37.771351
176.	Kathita Tributaries	Middle	0.08028324	37.767025
177.	Kathita Tributaries	Middle	0.08279614	37.772153
178.	Kathita Tributaries	Middle	0.08082855	37.773831
179.	Kathita Tributaries	Lower	0.07215737	37.780732
180.	Kathita Tributaries	Lower	0.07804991	37.772634
181.	Kathita Tributaries	Lower	0.00280096	37.580226
182.	Kathita Tributaries	Lower	-0.00093851	37.579078
183.	Kathita Tributaries	Lower	0.00400668	37.581346
184.	Kathita Tributaries	Lower	0.00175825	37.577407
185.	Kathita Tributaries	Lower	0.00256075	37.580762
186.	Kathita Tributaries	Lower	0.00021412	37.58152
187.	Kathita Tributaries	Lower	-0.00116214	37.577553
188.	Kayahwe	Upper	27205	9918537
189.	Kayahwe	Upper	27298	9918999
190.	Kayahwe	Upper	37M 0274114	UTM 9917518
191.	Kayahwe	Upper	37M 0268972	UTM9918987
192.	Kayahwe	Upper	37M 027298	UTM 9918999
193.	Kayahwe	Upper	37M 0268724	UTM 9919078
194.	Kayahwe	Middle	37M 0271763	UTM9918705
195.	Kayahwe	Middle	37M 027205	UTM 9918537
196.	Kayahwe	Middle	500 74.	820 00.808
197.	Kayahwe	Middle	500 74.871	E037 00.103
198.	Kayahwe	Middle	500 74.775	E037 00.177
199.	Kayahwe	Middle	-0.74365	37.00288
200.	Kayahwe	Middle	-0.74822	37.00149
201.	Kayahwe	Middle	-0.74577	37.00411
202.	Kayahwe	Middle	-0.74751	37.00403
203.	Kayahwe	Middle	-0.75159	37.00159
204.	Kayahwe	Middle	-0.74617	36.99829
205.	Kayahwe	Middle	-0.74917	36.99792
206.	Kayahwe	Lower	-0.74636	36.99972
207.	Kayahwe	lower	-0.74711	37.00304
208.	Kayahwe	Lower	-0.74964	37.00554
209.	Kayahwe	Lower	500 74.930	E037 02340
210.	Kayahwe	Lower	500 74.912	E037 02.211
211.	Kayahwe	Lower	500 74.792	E037 00.709

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
212.	Maara	Upper	348271	9970712
213.	Maara	Upper	347699	9970826
214.	Maara	Upper	348573	9970920
215.	Maara	Upper	347785	9970983
216.	Maara	Upper	348343	9971025
217.	Maara	Upper	418504	9950904
218.	Maara	Upper	416645	9951445
219.	Maara	Upper	417198	9951618
220.	Maara	Upper	411537	9951660
221.	Maara	Middle	347842	9970562
222.	Maara	Middle	347482	9970712
223.	Maara	Middle	348343	9970413
224.	Maara	Middle	394755	9970461
225.	Maara	Middle	-0.4407	37.7473
226.	Maara	Middle	-0.4475	37.7552
227.	Maara	Middle	-0.4355	37.753
228.	Maara	Middle	-0.4465	37.7568
229.	Maara	Middle	-0.44459	37.75687
230.	Maara	Middle	-0.44948	37.75445
231.	Maara	Middle	-0.44502	37.76102
232.	Maara	Middle	-0.44508	37.75453
233.	Maara	Middle	-0.44428	37.75552
234.	Maara	Middle	-0.45015	37.75444
235.	Maara	Middle	-0.45059	37.75759
236.	Maara	Middle	-0.44828	37.75428
237.	Maara	Middle	-0.44624	37.75559
238.	Maara	Middle	-0.44834	37.7556
239.	Maara	Lower	-0.35001	37.85813
240.	Maara	Lower	-0.34426	37.85721
241.	Maara	Lower	-0.3455	37.85612
242.	Maara	Lower	-0.34439	37.85301
243.	Maara	Lower	-0.34811	37.85241
244.	Maara	Lower	-0.34614	37.85179
245.	Maara	Lower	-0.34635	37.85343
246.	Maara	Lower	-0.34418	37.85659
247.	Maragua	Upper	259676	9921615
248.	Maragua	Upper	259740	9921849
249.	Maragua	Upper	262139	9914032
250.	Maragua	Upper	262338	9920993
251.	Maragua	Upper	262346	9920988
252.	Maragua	Upper	262675	9922433
253.	Maragua	Upper	273160	9914879
254.	Maragua	Upper	273164	9915682
255.	Maragua	Middle	273701	9914625
256.	Maragua	Middle	273804	9914500
257.	Maragua	Middle	274453	9914456
258.	Maragua	Middle	276391	9915665
259.	Maragua	Middle	279394	9914605
260.	Maragua	Middle	279751	9914001
261.	Maragua	Middle	279770	9914002
262.	Maragua	Middle	282583	9914895
263.	Maragua	Middle	283125	9914074
264.	Maragua	Middle	283162	9914015

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
265.	Maragua	Middle	-0.74879	37.16741
266.	Maragua	Middle	-0.7484	37.16897
267.	Maragua	Middle	-0.74602	37.16889
268.	Maragua	Middle	-0.74882	37.16986
269.	Maragua	Middle	-0.75116	37.16962
270.	Maragua	Middle	-0.7465	37.1672
271.	Maragua	Middle	-0.74854	37.17103
272.	Maragua	Middle	-0.74813	37.16963
273.	Maragua	Lower	-0.74788	37.16696
274.	Maragua	Lower	-0.75021	37.17009
275.	Maragua	Lower	-0.74854	37.16889
276.	Maragua	Lower	297970	9914686
277.	Maragua	Lower	298711	9915188
278.	Maragua	Lower	308255	9914889
279.	Mariara	Lower	356913	9996780
280.	Mariara	Lower	357359	9996816
281.	Mariara	Lower	35708	9996240
282.	Mariara	Lower	357408	9997191
283.	Mariara	Lower	356234	9996753
284.	Mariara	Lower	355502	9996197
285.	Mariara	Middle	356291	9996586
286.	Mariara	Middle	354587	9995757
287.	Mariara	Middle	352587	9995528
288.	Mariara	Middle	352980	9995805
289.	Mariara	Middle	354356	999700
290.	Mariara	Middle	352862	9995723
291.	Mariara	Middle	394163	9996784
292.	Mariara	Middle	399076	9996965
293.	Mariara	Middle	392998	9996650
294.	Mariara	Upper	392998	9996650
295.	Mariara	Middle	400868	9996860
296.	Mariara	Middle	395871	9996954
297.	Mariara	Upper	392716	9996882
298.	Mariara	Upper	392729	9996768
299.	Mariara	Upper	392184	9996462
300.	Mariara	Upper	398051	9996720
301.	Mariara	Upper	397624	9996855
302.	Mariara	Upper	395189	9997024
303.	Mathioya	Lower	369690.2	9880480
304.	Mathioya	Lower	292370	9879999
305.	Mathioya	Lower	273797	9933179
306.	Mathioya	Lower	273981	9933477
307.	Mathioya	Lower	274141	9933191
308.	Mathioya	Lower	274220	9933536
309.	Mathioya	Upper	274706	9933705
310.	Mathioya	Upper	274820	9933838
311.	Mathioya	Upper	275448	9933125
312.	Mathioya	Upper	275945	9933030
313.	Mathioya	Upper	277130	9932500
314.	Mathioya	Upper	277228	9932282
315.	Mathioya	Middle	279772	9930117
316.	Mathioya	Middle	286240	9882384
317.	Mathioya	Middle	285973	9882001

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
318.	Mathioya	Middle	289043	9880480
319.	Mathioya	Middle	295318	9870428
320.	Mathioya	Middle	294836	9865021
321.	Mathioya	Middle	292869	9879883
322.	Mathioya	Middle	294730	9879800
323.	Mathioya	Middle	293485	9879793
324.	Mathioya	Middle	293285	9879751
325.	Mathioya	Middle	294454	9879318
326.	Mathioya	Middle	286480	9881936
327.	Murubara	Middle	313042	9936473
328.	Murubara	Middle	313282	9936658
329.	Murubara	Middle	315440	9934414
330.	Murubara	Middle	316141	9934741
331.	Murubara	Middle	316281	9935586
332.	Murubara	Middle	316357	9935100
333.	Murubara	Middle	316700	9935774
334.	Murubara	Middle	316783	9936180
335.	Murubara	Middle	316848	9934037
336.	Murubara	Middle	316906	9934657
337.	Murubara	Middle	316927	9936568
338.	Murubara	Middle	317178	9933786
339.	Murubara	Middle	317379	9937638
340.	Murubara	Upper	317722	9946813
341.	Murubara	Upper	317794	9946179
342.	Murubara	Lower	317805	992855
343.	Murubara	Upper	317814	9947113
344.	Murubara	Upper	317890	9947316
345.	Murubara	Upper	318037	9947495
346.	Murubara	Lower	318140	9927273
347.	Murubara	Lower	318272	9924635
348.	Murubara	Upper	318274	9947913
349.	Murubara	Middle	318528	9925979
350.	Murubara	Lower	318639	9925479
351.	Murubara	Upper	318721	9948147
352.	Murubara	Upper	318814	9947790
353.	Murubara	Lower	321103	9923545
354.	Murubara	Lower	325213	9921860
355.	Mutonga Tributaries	Middle	37M 0353743	UTM 9968589
356.	Mutonga Tributaries	Middle	37M 03532903	UTM 9969254
357.	Mutonga Tributaries	Middle	37M 0352330	UTM 9969834
358.	Mutonga Tributaries	Middle	37M O352441	UTM 9969679
359.	Mutonga Tributaries	Middle	37M B51843	UTM 9969771
360.	Mutonga Tributaries	Middle	37M B511750	UTM 9969553
361.	Mutonga Tributaries	Middle	37M O351430	UTM 9968752
362.	Mutonga Tributaries	Middle	37M 0351429	UTM9968044
363.	Mutonga Tributaries	Middle	37M B49374	UTM 9969097
364.	Mutonga Tributaries	Middle	37M B51125	UTM 9968893
365.	Mutonga Tributaries	Middle	37M B49659	UTM 996934
366.	Mutonga Tributaries	Middle	37M B49442	UTM 9469436
367.	Mutonga Tributaries	Middle	307 37M 0372497	UTM 9957371
368.	Mutonga Tributaries	Middle	37M 0372576 299	UTM 9957027
369.	Mutonga Tributaries	Middle	37M 0372428 300	UTM 9957067
370.	Mutonga Tributaries	Middle	37M 0372457	UTM 9957251

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
371.	Mutonga Tributaries	Middle	37M 0372942	UTM 9957338
372.	Mutonga Tributaries	Lower	-0.35088384	37.873162
373.	Mutonga Tributaries	Lower	-0.35378088	37.871101
374.	Mutonga Tributaries	Lower	-0.36076366	37.873234
375.	Mutonga Tributaries	Lower	-0.35862493	37.873264
376.	Mutonga Tributaries	Lower	-0.35765592	37.867315
377.	Mutonga Tributaries	Lower	-0.3585037	37.870156
378.	Mutonga Tributaries	Lower	-0.36184532	37.870894
379.	Mutonga Tributaries	Lower	-0.36080894	37.868682
380.	Mutonga Tributaries	Lower	-0.3540943	37.86629
381.	Mutonga Tributaries	Upper	-0.38622271	37.617013
382.	Mutonga Tributaries	Upper	-0.38635738	37.61739
383.	Mutonga Tributaries	Upper	-0.38627271	37.616208
384.	Mutonga Tributaries	Upper	-0.38665684	37.617166
385.	Mutonga Tributaries	Upper	-0.38668754	37.616275
386.	Mutonga Tributaries	Upper	-0.38725439	37.616246
387.	Mutonga Tributaries	Upper	-0.38587759	37.616527
388.	Mutonga Tributaries	Upper	-0.38583282	37.616127
389.	Mutonga Tributaries	Upper	0.38567629	37.616587
390.	Nairobi	Upper	-0.2128116	37.10654
391.	Nairobi	Upper	-0.2226528	37.10733
392.	Nairobi	Upper	-0.2219402	37.10531
393.	Nairobi	Upper	-0.2158673	37.10295
394.	Nairobi	Upper	-0.2146826	37.1017
395.	Nairobi	Upper	-0.2206625	37.10161
396.	Nairobi	Upper	-0.2175326	37.10106
397.	Nairobi	Upper	-0.2139412	37.11062
398.	Nairobi	Upper	-0.2192729	37.10288
399.	Nairobi	Middle	-0.212532	37.106359
400.	Nairobi	Middle	-0.2143393	37.10559
401.	Nairobi	Middle	-0.2251423	37.10313
402.	Nairobi	Middle	-0.4130828	37.01911
403.	Nairobi	Middle	-0.4105536	37.02761
404.	Nairobi	Middle	-0.4113469	37.01541
405.	Nairobi	Middle	-0.4090025	37.02841
406.	Nairobi	Middle	-0.410097	37.02435
407.	Nairobi	Middle	-0.4035462	37.02221
408.	Nairobi	Middle	-0.4086915	37.01938
409.	Nairobi	Middle	-0.4066671	37.02783
410.	Nairobi	Middle	-0.4080381	37.02704
411.	Nairobi	Middle	-0.4092429	37.01945
412.	Nairobi	Middle	-0.405015	37.02041
413.	Nairobi	Middle	-0.4081959	37.01846
414.	Nairobi	Middle	-0.402427	37.02043
415.	Nairobi	Lower	-0.4128689	37.01796
416.	Nairobi	Lower	-0.4080837	37.01892
417.	Nairobi	Lower	-0.4055954	37.01578
418.	Nairobi	Lower	0.4103081	37.02236
419.	Nairobi	Lower	-0.4076382	37.01652
420.	Nairobi	Lower	-0.39202	37.00384
421.	Nairobi	Lower	-0.39054	37.00006
422.	Nairobi	Lower	36.60952	37.00383
423.	Nairobi	Lower	-0.39634316	37.00376

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
424.	Nyamindi	Upper	320944	9950778
425.	Nyamindi	Upper	321379	995037
426.	Nyamindi	Upper	321204	9951239
427.	Nyamindi	Upper	321989	9950722
428.	Nyamindi	Upper	322104	9950173
429.	Nyamindi	Upper	322013	9950411
430.	Nyamindi	Upper	321537	9949775
431.	Nyamindi	Upper	321181	9950065
432.	Nyamindi	Upper	321989	9950173
433.	Nyamindi	Middle	-0.46994942	37.3942
434.	Nyamindi	Middle	-0.46994942	37.39269
435.	Nyamindi	Middle	320518	9948430
436.	Nyamindi	Middle	320964	9948451
437.	Nyamindi	Middle	321357	9950159
438.	Nyamindi	Middle	321983	9949878
439.	Nyamindi	Middle	-0.47553312	37.39355
440.	Nyamindi	Middle	-0.47431197	37.39269
441.	Nyamindi	Middle	-0.45937234	37.39669
442.	Nyamindi	Middle	-0.47036041	37.3965
443.	Nyamindi	Middle	-0.46994942	37.392
444.	Nyamindi	Middle	-0.47165403	37.39818
445.	Nyamindi	lower	0.45869	37.39178
446.	Nyamindi	lower	-0.47518999	37.39722
447.	Nyamindi	lower	-0.46514105	37.3903
448.	Nyamindi	lower	-0.47503983	37.39801
449.	Nyamindi	lower	-0.4647641	37.38658
450.	Nyamindi	lower	-0.46547356	37.39126
451.	Ragati	Upper	296071	99898
452.	Ragati	Lower	29888	9939181
453.	Ragati	Upper	37 M 0296071	UTM99898
454.	Ragati	Upper	37M 0294949	UTM 9957461
455.	Ragati	Upper	37M 0293552	UTM 9950891
456.	Ragati	Upper	37M 0295049	UTM 9958890
457.	Ragati	Upper	37M 0294177	UTM 9957131
458.	Ragati	Upper	37M 0294797	VTM 9953724
459.	Ragati	Upper	37M 0294511	UTM 9954310
460.	Ragati	Upper	37M 0294117	UTM 9955109
461.	Ragati	Upper	37M 0295219	UTM 9952692
462.	Ragati	Upper	37M 0294505	UTM 9952162
463.	Ragati	Upper	37M 0294110	UTM 9951559
464.	Ragati	Upper	37M 0293890	UTM 9951239
465.	Ragati	Middle	S 00 26.927	E037 08.076
466.	Ragati	Middle	S 00 26.970,	E 037 08.436
467.	Ragati	Middle	S 00 26.869	E 037 08.233
468.	Ragati	Middle	S 00 28. 437	E 037.823
469.	Ragati	Middle	S 00 28.523	E037 07.824
470.	Ragati	Middle	S 00 28.320	E037 07.821
471.	Ragati	Middle	S 00 28.403	E 037.903
472.	Ragati	Middle	S 00 28.277	E037 07.801
473.	Ragati	Middle	S 00 28.279	E 037 07.802
474.	Ragati	Middle	S 00 28.278	E 037 07.801
475.	Ragati	Middle	S 00 28.277	E 037 07.801
476.	Ragati	Middle	S 00 27.104	E 037 07.894

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
477.	Ragati	Middle	S 00 27.104	E 037 07.894
478.	Ragati	Middle	S 00 27.102	E 037 07.893
479.	Ragati	Middle	S 00 27.102	E 037 07.893
480.	Ragati	Middle	S 00 26.782	E 037 08.286
481.	Ragati	Middle	S 00 26.782	E 037 08.286
482.	Ragati	Middle	S 00 26.782	E 037 08.286
483.	Ragati	Middle	S 00 26.782	E 037 08.286
484.	Ragati	Lower	S 00 34. 038	E 037 11.313
485.	Ragati	Lower	S 00 35. 404	E 037 11.609
486.	Ragati	Lower	S 00 34. 728	E 037 11.287
487.	Ragati	Lower	37M 0297695	UTM 9941559
488.	Ragati	Lower	37M 0298278	UTM 9938125
489.	Ragati	Lower	37M 029888	UTM 9939181
490.	Ragati	Lower	37M 0293714	UTM 9945092
491.	Ragati	Lower	37 M 0295721	UTM 9943918
492.	Ragati	Lower	37 M 0297861	UTM 9940877
493.	Ruguti	Upper	37 M 031998	UTM 9940044
494.	Ruguti	Upper	37 M 0315047	UTM 9939805
495.	Ruguti	Upper	37 M 0315268	UTM 9939690
496.	Ruguti	Upper	37 M 0315154	UTM 9939369
497.	Ruguti	Upper	37 M 0314898	UTM 9939369
498.	Ruguti	Upper	37 M 0353505	UTM 9939190
499.	Ruguti	Middle	37 M 0353319	UTM 9945177
500.	Ruguti	Middle	37 M 0346445	UTM 9946843
501.	Ruguti	Middle	37 M 0346529	UTM 9959341
502.	Ruguti	Middle	37 M 0346604	UTM 9959355
503.	Ruguti	Middle	37 M 0346592	UTM 9959349
504.	Ruguti	Middle	37 M 0346628	UTM 9959358
505.	Ruguti	Middle	37 M 0346705	UTM 9959360
506.	Ruguti	Middle	37 M 0346750	UTM 9959374
507.	Ruguti	Middle	37 M 0347049	UTM 9959276
508.	Ruguti	Middle	-0.3584	37.8753
509.	Ruguti	Middle	-0.356	37.8671
510.	Ruguti	Lower	-0.3615	37.8716
511.	Ruguti	Lower	-0.3571	37.8727
512.	Ruguti	Lower	-0.3543	37.8718
513.	Ruguti	Lower	-0.3492	37.868
514.	Ruguti	Lower	-0.358	37.8711
515.	Rujirweru	Upper	-0.3566	37.8728
516.	Rujirweru	Upper	-0.3571	37.8726
517.	Rujirweru	Upper	-0.3525	37.8692
518.	Rujirweru	Upper	-0.3492	37.8665
519.	Rujirweru	Upper	-0.3609	37.8738
520.	Rujirweru	Upper	-0.3676	37.6171
521.	Rujirweru	Upper	-0.3631	37.6151
522.	Rujirweru	Upper	-0.3684	37.6201
523.	Rujirweru	Upper	-0.3651	37.6146
524.	Rujirweru	Middle	-0.369	37.6169
525.	Rujirweru	Middle	-0.3695	37.6191
526.	Rujirweru	Middle	-0.3647	37.6166
527.	Rujirweru	Middle	-0.365	37.6179
528.	Rujirweru	Middle	9971128	37.6166
529.	Rujirweru	Middle	-0.365	37.6154

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
530.	Rujirweru	Middle	-0.3666	37.6147
531.	Rujirweru	Middle	-0.3634	37.6165
532.	Rujirweru	Middle	395085	9975474
533.	Rujirweru	Middle	389640	9971735
534.	Rujirweru	Middle	395180	9975530
535.	Rujirweru	Middle	391784	9975174
536.	Rujirweru	Middle	389722	9971817
537.	Rujirweru	Middle	391784	9973024
538.	Rujirweru	Middle	391420	9972760
539.	Rujirweru	Middle	394951	9975462
540.	Rujirweru	Middle	389803	9971821
541.	Rujirweru	Middle	349766	9970959
542.	Rujirweru	Lower	382356	9971159
543.	Rujirweru	Lower	382356	9970934
544.	Rujirweru	Lower	383239	9970385
545.	Rujirweru	Lower	381599	9971128
546.	Rujirweru	Lower	383330	9969967
547.	Rujirweru	Lower	383102	9971883
548.	Rujirweru	Lower	383228	9970944
549.	Rujirweru	Lower	383180	9970461
550.	Rujirweru	Lower	382491	9970851
551.	Rujirweru	Lower	381649	9971155
552.	Rujirweru	Lower	382141	9971327
553.	Rupiingazi	Middle	323055	9939693
554.	Rupiingazi	Middle	328266	9938737
555.	Rupiingazi	Middle	328618	9938685
556.	Rupiingazi	Middle	328239	9938372
557.	Rupiingazi	Middle	327569	9938244
558.	Rupiingazi	Middle	328171	9938188
559.	Rupiingazi	Middle	328328	9938167
560.	Rupiingazi	Middle	327634	9938056
561.	Rupiingazi	Middle	328446	9952511
562.	Rupiingazi	Middle	327875	9948947
563.	Rupiingazi	Middle	298008	9948616
564.	Rupiingazi	Middle	327823	9948357
565.	Rupiingazi	Middle	318272	9924637
566.	Rupingazi	Upper	323595	9950998
567.	Rupingazi	Upper	323596	9951103
568.	Rupingazi	Upper	323683	9950527
569.	Rupingazi	Upper	323694	9950531
570.	Rupingazi	Upper	324928	9950458
571.	Rupingazi	Upper	324956	9950024
572.	Rupingazi	Upper	325068	9950219
573.	Rupingazi	Upper	325090	9950655
574.	Rupingazi	Upper	325196	9949550
575.	Rwamuthambi	Middle	-0.6212	37.25383
576.	Rwamuthambi	Middle	-0.62164857	37.25158
577.	Rwamuthambi	Middle	-0.62091812	37.25207
578.	Rwamuthambi	Middle	-0.61973826	37.25167
579.	Rwamuthambi	Middle	-0.62445698	37.25602
580.	Rwamuthambi	Middle	-0.62394694	37.25162
581.	Rwamuthambi	Middle	-0.62216441	37.254
582.	Rwamuthambi	Middle	-0.62138927	37.2512

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
583.	Rwamuthambi	Middle	301548	9942700
584.	Rwamuthambi	Middle	300339	9947154
585.	Rwamuthambi	Middle	300284	9947326
586.	Rwamuthambi	Middle	300627	9946667
587.	Rwamuthambi	Upper	303697	9949421
588.	Rwamuthambi	Upper	303642	9946768
589.	Rwamuthambi	Upper	301211	9947243
590.	Rwamuthambi	Upper	301211	9942993
591.	Rwamuthambi	Upper	303582	9949417
592.	Rwamuthambi	Upper	303702	9949222
593.	Rwamuthambi	Lower	301453	9942681
594.	Rwamuthambi	Lower	301193	9943111
595.	Rwamuthambi	Lower	322479	9894065
596.	Rwamuthambi	Lower	322747	9890639
597.	Rwamuthambi	Lower	322352	9895445
598.	Rwamuthambi	Lower	301193	9892399
599.	Sabasaba	Middle	322419	9894675
600.	Sabasaba	Middle	322467	9894842
601.	Sabasaba	Middle	-0.7840726	36.90534
602.	Sabasaba	Middle	-0.7871014	36.91263
603.	Sabasaba	Middle	-0.7843844	36.91105
604.	Sabasaba	Middle	-0.7884202	36.91128
605.	Sabasaba	Middle	-0.7847187	36.91775
606.	Sabasaba	Middle	-0.7887013	36.90508
607.	Sabasaba	Middle	-0.7890478	36.90608
608.	Sabasaba	Middle	-0.7890951	36.90857
609.	Sabasaba	Middle	-0.7891198	36.90905
610.	Sabasaba	Middle	-0.7916045	36.91482
611.	Sabasaba	Middle	-0.8133441	36.94711
612.	Sabasaba	Middle	-0.8129949	36.95418
613.	Sabasaba	Middle	-0.8090656	36.97792
614.	Sabasaba	Middle	-0.8243507	37.24925
615.	Sabasaba	Middle	-0.8408713	37.23941
616.	Sabasaba	Middle	-0.8301726	37.23656
617.	Sabasaba	Lower	-0.8271434	37.23869
618.	Sabasaba	Lower	-0.8201092	37.21786
619.	Sabasaba	Lower	-0.8269023	37.21593
620.	Sabasaba	Lower	-0.8156968	37.24395
621.	Sabasaba	Lower	-0.8370022	37.23856
622.	Sabasaba	Lower	-0.8210158	37.24689
623.	Sabasaba	Lower	-0.8246135	37.21233
624.	Sabasaba	Lower	-0.8291433	37.2248
625.	Sabasaba	Lower	-0.8164772	37.22074
626.	Sabasaba	Lower	-0.8202839	37.2361
627.	Sabasaba	Lower	-0.8178841	37.247
628.	Sabasaba	Lower	-0.8408056	37.21999
629.	Sabasaba	Lower	-0.8354366	37.23014
630.	Sabasaba	Lower	-0.8270746	37.22457
631.	Sabasaba	Upper	-0.8241597	36.9592
632.	Sabasaba	Upper	-0.8180749	36.96818
633.	Sabasaba	Upper	-0.8107823	36.97431
634.	Sabasaba	Upper	-0.7931698	36.97024
635.	Sabasaba	Upper	-0.7903707	36.95115

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
636.	Sabasaba	Upper	-0.7846745	36.96437
637.	Sabasaba	Upper	-0.8090695	36.94741
638.	Sabasaba	Upper	-0.8031378	36.96861
639.	Sabasaba	Upper	-0.7879131	36.9583
640.	Sagana	Upper	-0.43517	37.00665
641.	Sagana	Upper	-0.5321985	36.91647
642.	Sagana	Upper	-0.4500327	36.96325
643.	Sagana	Upper	-0.5162205	36.89883
644.	Sagana	Upper	-0.4596831	36.93421
645.	Sagana	Upper	-0.5014081	36.92339
646.	Sagana	Upper	-0.5095391	36.9674
647.	Sagana	Middle	-0.4317066	37.11891
648.	Sagana	Middle	-0.4606722	37.09261
649.	Sagana	Middle	-0.5173346	37.09121
650.	Sagana	Middle	-0.4183004	37.05305
651.	Sagana	Middle	-0.4216569	37.05409
652.	Sagana	Middle	-0.414836	37.05006
653.	Sagana	Middle	-0.4155152	37.0459
654.	Sagana	Middle	-0.4118634	37.04947
655.	Sagana	Middle	-0.4162839	37.05129
656.	Sagana	Middle	-0.4204846	37.0501
657.	Sagana	Middle	-0.4130473	37.04471
658.	Sagana	Middle	-0.415881	37.04984
659.	Sagana	Lower	-0.4104461	37.05239
660.	Sagana	Lower	-0.4165454	37.04907
661.	Sagana	Lower	-0.4210864	37.05552
662.	Sagana	Lower	-0.4130035	37.04908
663.	Sagana	Lower	-0.4225537	37.04993
664.	Sagana	Lower	-0.4171582	37.05365
665.	Sagana	Lower	-0.4198213	37.0456
666.	Sagana	Lower	-0.4137134	37.04612
667.	Sagana	Lower	-0.4137134	37.05022
668.	Thanantu	Upper	0.0595027	37.78541
669.	Thanantu	Upper	0.0546176	37.80074
670.	Thanantu	Upper	0.1032309	37.80365
671.	Thanantu	Upper	0.1312266	37.76084
672.	Thanantu	Upper	0.1141433	37.7751
673.	Thanantu	Upper	0.1898839	37.84434
674.	Thanantu	Upper	0.0861969	37.86272
675.	Thanantu	Upper	0.1544533	37.90169
676.	Thanantu	Upper	0.2007551	37.82082
677.	Thanantu	Middle	0.1059284	37.8659
678.	Thanantu	Middle	0.1420236	37.82921
679.	Thanantu	Middle	0.103453	37.75129
680.	Thanantu	Middle	0.1324969	37.86031
681.	Thanantu	Middle	0.0979536	37.81539
682.	Thanantu	Middle	0.0402534	37.85212
683.	Thanantu	Middle	-0.0879663	37.99792
684.	Thanantu	Middle	-0.0935589	37.99942
685.	Thanantu	Middle	-0.093959	38.00745
686.	Thanantu	Middle	-0.09447	38.0098
687.	Thanantu	Middle	-0.0951104	38.01111
688.	Thanantu	Middle	-0.1046179	38.01223

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
689.	Thanantu	Middle	-0.1048374	38.01463
690.	Thanantu	Middle	-0.1051872	38.01559
691.	Thanantu	Middle	-0.1063759	38.01576
692.	Thanantu	Middle	-0.1071173	38.0168
693.	Thanantu	Middle	-0.1082683	38.01861
694.	Thanantu	Middle	-0.1083648	38.02136
695.	Thanantu	Lower	0.22389463	38.022122
696.	Thanantu	Lower	0.22403718	38.021097
697.	Thanantu	Lower	0.22413634	38.022543
698.	Thanantu	Lower	0.22519492	38.021418
699.	Thanantu	Lower	0.22373966	38.022326
700.	Thanantu	Lower	0.22355074	38.021566
701.	Thanantu	Lower	0.22460743	38.022076
702.	Thanantu	Lower	0.22412208	38.022532
703.	Thanantu	Lower	0.22458629	38.022428
704.	Thangatha	Middle	0.07459	37. 54024
705.	Thangatha	Middle	0. 08001	37 .53067
706.	Thangatha	Middle	0.07548	37.9 53734
707.	Thangatha	Middle	0. 07733	37. 53290
708.	Thangatha	Middle	0.09086	37. 52697
709.	Thangatha	Middle	0. 08416	37 .52805
710.	Thangatha	Middle	0. 08957	37. 53715
711.	Thangatha	Middle	0. 08286	37. 52887
712.	Thangatha	Middle	0. 08371	37 .52859
713.	Thangatha	Middle	0. 09177	37. 52694
714.	Thangatha	Middle	0. 09332	37 .52642
715.	Thangatha	Middle	0. 08837	37. 52754
716.	Thangatha	Middle	0. 07859	37 .53161
717.	Thangatha	Middle	0.0866	37. 52759
718.	Thangatha	Middle	0. 08209	37 .52953
719.	Thangatha	Middle	37N 0374998	UTM 0020515
720.	Thangatha	Middle	37N 0374896	UTM 0018741
721.	Thangatha	Middle	37N 0374798	UTM 0020570
722.	Thangatha	Upper	37N 037163	UTM 0017825
723.	Thangatha	Upper	37N 0373397	UTM 0016874
724.	Thangatha	Upper	37N 0375151	UTM 0019176
725.	Thangatha	Upper	37N 0373747	UTM 0017302
726.	Thangatha	Upper	37N 0373314	UTM 0017291
727.	Thangatha	Upper	37N 0373314	UTM 0016788
728.	Thangatha	Upper	0.6648	37.93967
729.	Thangatha	Upper	0.06248	37.95155
730.	Thangatha	Upper	0.0624	37.95746
731.	Thangatha	Lower	0.08481	37.92622
732.	Thangatha	Lower	0.7038	37.93959
733.	Thangatha	Lower	0.0667	37.9406
734.	Thangatha	Lower	0.06392	37.9495
735.	Thangatha	Lower	0.8762	37.92219
736.	Thangatha	Lower	0.06761	37.94221
737.	Thangatha	Lower	0.06283	37.9541
738.	Thangatha	Lower	0.0641	37.95146
739.	Thangatha	Lower	0.08279	37.92779
740.	Thiba	Upper	-0.5480425	37.33824
741.	Thiba	Upper	-0.558163	37.33752

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
742.	Thiba	Upper	-0.5748698	37.33792
743.	Thiba	Upper	-0.5760227	37.29701
744.	Thiba	Upper	-0.5608846	37.32021
745.	Thiba	Upper	-0.5482369	37.31457
746.	Thiba	Upper	-0.5585833	37.31828
747.	Thiba	Upper	-0.5786471	37.33501
748.	Thiba	Upper	-0.5777819	37.32398
749.	Thiba	Middle	-0.5820677	37.30532
750.	Thiba	Middle	-0.5584795	37.32509
751.	Thiba	Middle	-0.5833305	37.30382
752.	Thiba	Middle	-0.5686583	37.32289
753.	Thiba	Middle	-0.5671445	37.34851
754.	Thiba	Middle	-0.5987941	37.33391
755.	Thiba	Middle	-0.5825492	37.31374
756.	Thiba	Middle	-0.58536	37.31694
757.	Thiba	Middle	-0.58416	37.31264
758.	Thiba	Middle	-0.58376	37.3104
759.	Thiba	Middle	-0.58531	37.31108
760.	Thiba	Middle	-0.58332	37.31456
761.	Thiba	Middle	-0.58551	37.31637
762.	Thiba	Middle	-0.5833	37.31507
763.	Thiba	Middle	-0.57844	37.31328
764.	Thiba	Middle	-0.58244	37.31214
765.	Thiba	Middle	-0.57955	37.31224
766.	Thiba	Middle	-0.5696141	37.33906
767.	Thiba	Lower	-0.5784457	37.34982
768.	Thiba	Lower	70261	9919176
769.	Thiba	Lower	330573	991929
770.	Thiba	Lower	32956	9903773
771.	Thiba	Lower	332216	9918255
772.	Thiba	Lower	329061	9920083
773.	Thiba	Lower	329247	9919462
774.	Thiba	Lower	330609	9919199
775.	Thiba	Lower	329920	9919037
776.	Thika	Lower	-1.010607	37.0821
777.	Thika	Lower	-1.0483547	37.06413
778.	Thika	Lower	-1.0208665	37.07149
779.	Thika	Lower	-1.0211944	37.10467
780.	Thika	Lower	-0.9948471	37.07278
781.	Thika	Lower	-1.0546804	37.05524
782.	Thika	Lower	-1.0136485	37.10589
783.	Thika	Middle	-1.0000064	37.07881
784.	Thika	Middle	-1.0167291	37.07334
785.	Thika	Middle	-1.0191189	37.06797
786.	Thika	Middle	-1.000755	37.07516
787.	Thika	Middle	-0.9748448	37.06783
788.	Thika	Middle	-1.038346	37.04298
789.	Thika	Middle	-1.0388063	37.0281
790.	Thika	Middle	-1.0401178	37.03884
791.	Thika	Middle	-1.0221982	37.03773
792.	Thika	Middle	-1.0243643	37.03415
793.	Thika	Middle	-1.0125682	37.0558
794.	Thika	Middle	-1.0167291	37.07336

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
795.	Thika	Upper	-0.7879818	36.8103
796.	Thika	Upper	-0.8463969	36.81704
797.	Thika	Upper	-0.8335817	36.832
798.	Thika	Upper	-0.8641952	36.83643
799.	Thika	Upper	-0.8138027	36.81174
800.	Thika	Upper	-0.8260427	36.84913
801.	Thika	Upper	-0.8125395	36.86593
802.	Thika	Upper	-0.8106468	36.81038
803.	Thika	Upper	-0.8465011	36.80153
804.	Thika	Upper	-0.8143921	36.81653
805.	Thika	Upper	-0.8316533	36.85412
806.	Thika	Upper	-0.8279576	36.79391
807.	Thika	Upper	-0.7806085	36.82388
808.	Thika	Upper	-0.8526771	36.82883
809.	Thika	Upper	-0.8014023	36.85009
810.	Thika	Upper	-0.8245341	36.86567
811.	Thika	Upper	-0.784373	36.80964
812.	Thika	Upper	-0.8611768	36.80769
813.	Thingithu	Lower	-0.1341557	37.96501
814.	Thingithu	Lower	0.0203748	38.00098
815.	Thingithu	Lower	-0.2861877	37.99478
816.	Thingithu	Lower	-0.323519	38.00951
817.	Thingithu	Lower	-0.3025136	38.01413
818.	Thingithu	Lower	-0.1198764	37.86823
819.	Thingithu	Lower	-0.2267941	37.85013
820.	Thingithu	Lower	-0.020582	37.88095
821.	Thingithu	Lower	-0.2800933	38.0469
822.	Thingithu	Middle	-0.2934022	37.88056
823.	Thingithu	Middle	-0.1332727	37.8527
824.	Thingithu	Middle	-0.2572223	37.10706
825.	Thingithu	Middle	-0.1457098	37.89214
826.	Thingithu	Middle	-0.1090241	37.9593
827.	Thingithu	Middle	-0.1260099	37.0093
828.	Thingithu	Middle	-0.1213175	37.09932
829.	Thingithu	Middle	-0.2529723	37.86813
830.	Thingithu	Middle	0.1059388	37.70764
831.	Thingithu	Middle	0.1185288	37.71764
832.	Thingithu	Upper	-0.1705567	37.71905
833.	Thingithu	Upper	-0.1329786	37.56341
834.	Thingithu	Upper	0.0079139	37.56626
835.	Thingithu	Upper	0.0799169	37.69433
836.	Thingithu	Upper	0.0133455	37.56715
837.	Thingithu	Upper	-0.130609	37.61066
838.	Thingithu	Upper	0.0357058	37.57613
839.	Thingithu	Upper	0.0759952	37.76453
840.	Thingithu	Upper	0.029245	37.54235
841.	Ura	Middle	0.2105986	37.93329
842.	Ura	Middle	0.2094748	37.94399
843.	Ura	Middle	0.2048261	37.93266
844.	Ura	Middle	0.2101195	37.92377
845.	Ura	Middle	0.2172725	37.9454
846.	Ura	Middle	0.2164466	37.93768
847.	Ura	Middle	0.207645	37.94692

BASELINE SURVEY FOR UPPER TANA NRM PROJECT HOUSEHOLD GPS COORDINATES				
No	**River Basin**	**Zone**	**Latitude**	**Longitude**
848.	Ura	Middle	0.2039531	37.94491
849.	Ura	Middle	0.2075216	37.94529
850.	Ura	Middle	0.2152183	37.93423
851.	Ura	Middle	0.2039141	37.93004
852.	Ura	Middle	0.2065733	37.94141
853.	Ura	Lower	0.2017641	37.9466
854.	Ura	Lower	0.2109948	37.94312
855.	Ura	Lower	0.2211685	37.93633
856.	Ura	Lower	0.206893	37.927
857.	Ura	Lower	0.201794	37.93693
858.	Ura	Lower	0.1994243	37.93121
859.	Ura	Upper	37 N 038736 292	UTM 0021505
860.	Ura	Upper	00 21. 358	037 92.410
861.	Ura	Upper	00 21. 754	037 92.001
862.	Ura	Upper	37 M 0380492	UTM 0021671
863.	Ura	Upper	37 N 0380736	UTM 0021505
864.	Ura	Upper	00 21.460	037 92.217

APPENDIX 6: MAPS – ATTACHED SEPARATELY