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1. Introduction

A livelihood comprises the capabilities, assets and activities required for obtaining a means of living (Chambers & Conway.1992; DFID 1999). Usually livelihoods includes complex, contextual, diverse and dynamic strategies developed by households to meet their needs" (Gaillard et al. 2009).

Livelihood studies were brought to the centre stage of development studies in the late 1990s, when the so-called Sustainable Livelihood Framework was strongly promoted by the Department for International Development (DFID), the British state development cooperation agency (De Haan, 2012).

The livelihoods framework is a way of understanding how households derive their livelihoods by drawing on capabilities and assets to develop livelihood strategies composed of a range of activities. It seeks to understand the various dimensions of a person's livelihood; the strategies and objectives pursued, and associated opportunities and constraints. Livelihoods framework presents the main factors that affect people's livelihoods, and typical relationships between these. It can be used in both planning new development activities and assessing the contribution to livelihood sustainability made by existing activities.

This report follows the DFID livelihood framework, where people stood at the center and were seen to build their livelihood strategies on a set of vital livelihood resources called capitals/assets. Livelihood strategies are types of activities performed by people to transform their assets and capabilities to meet particular livelihood outcomes. Livelihood outcomes are the achievements or outputs of livelihood strategies, such as more income, increased well-being, reduce vulnerability, improved food security and a more sustainable use of natural resources.

All livelihood strategies depend upon access to assets of some kind or other, which could be accessed privately or communally. In the livelihoods framework, assets are divided into the following (DFID 1999):

- Natural capital – natural resource stocks (soil, water, air, forests, etc.) and environmental services (hydrological cycle, etc).
- Financial capital – the capital base (cash, credit/debt, savings, etc.).
- Human capital –skills, knowledge, ability to labour and good health.
- Social capital – social resources (networks, social relations, affiliations, associations, organizations, etc.).
- Physical capital – infrastructure (roads, railways, water, schools, processing and manufacturing facilities, etc.).

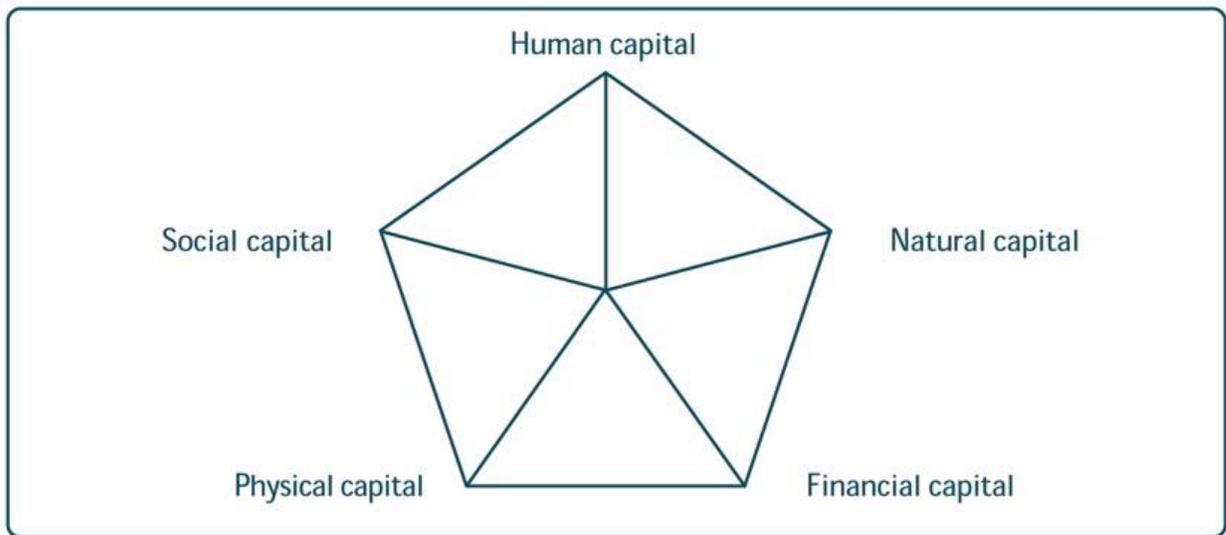


Fig. 1The asset pentagon (Source: DFID 1999)

People tend to have better livelihood outcome, when they livelihood is dependent up on multiple assets. The more accessible these assets are, the more strategies one has to choose from. Therefore, **livelihood strategies** may focus on increasing the range of assets to which a person or household has access, or on increasing access to particular types of capital in order to. The ultimate objective of these livelihood strategies is to improve long-term livelihood security and the quality of life more generally.

Households and community livelihoods could be affected by natural and anthropogenic hazards. Flooding is one of the most common types of disaster affecting livelihood of

people in various parts of the world. Flooding is divided into three major types: river floods, flash floods and coastal floods (Smith and Ward 1998).

The causes of floods could be climatological forces (notably rainfall), removal of vegetation and urban development (Nott 2006). The most common causes of floods are due to intense and prolonged rainfall. Human impacts on river catchments influence flood behavior. Vegetation removal results in increased run-off and often a decrease in channel capacity due to increased sedimentation rates. Land use changes in particular have a direct impact on the magnitude and behavior of floods. Urban development increases impervious surface cover resulting in decreased infiltration and increased runoff exacerbating flood risks and vulnerability to communities living in flood risk areas. Flooding in urban areas has enormous social, economic and environmental impacts.

Workpackage 1 (Urban ecology, green spaces; use and livelihoods) of the Water Resilient Green Cities in Africa (WGA) research project tries to explore the use, functions, and livelihood activities in the urban green spaces and identify opportunities and barriers for integrating stormwater management in the urban landscape.

This report presents the importance of livelihood activities obtained from the urban green space in the WGA case sites both in Addis Ababa and Dar es Salaam, how the livelihoods are threatened by water stress and the interrelation between the different land uses and stormwater management.

More specifically the report tries to

- investigate the importance and value of local green and water resources (as natural assets of households and communities) within the livelihood framework of the case study community
- examine the access to local green and water resources by different groups
- identify vulnerability of households to water stress (flooding and water shortage)

- explore the existing local coping mechanisms to flooding and water shortage that households and communities are following
- devise strategies and mechanisms of linking landscape based stormwater management (LSM) to livelihood issues

2. Description of selected river catchment

The livelihood assessment study was made in the case sites located along Little Akaki River catchment in Addis Ababa and Mbezi River catchment in Dar es Salaam.

2.1 The Little Akaki River catchment, Addis Ababa

The Little Akakai river starts on the flanks of Wechacha mountain northwest of Addis Ababa, drains the western part of the city and flows for 40 km before it reaches to Aba Samuel reservoir, originally built for hydropower. The Little Akaki River catchment is covering around 54,000 hectares that cut across the regional boundaries of Oromia Regional State and Addis Ababa City Administration. The landscape within the Little Akakai River catchment is variable with rugged topography, mountains, steep slopes, areas with moderate slope and flood plains. The catchment stretches from Gefersa dam in the upstream (which is one of the major surface water sources of the city) up to Lake Aba Samuel in the southeastern part of the city. Within the catchment, there are thirteen tributary rivers directly joining to the Little Akaki River.

Sebeta, Alem Gena, Gefersa, and Burayu towns are towns in the Oromia Regional State also found within the catchment. The western part of Addis Ababa is drained by the Little Akaki River and this covers almost one third of the city. The catchment includes part of the Gulele, Addis Ketema, Lideta, Nifas Silk- Lafto and Akaki-Kality sub cities and the whole of Kolfe Keraniyo sub city. A total of 63 weredas from Addis Ababa are found in the catchment.

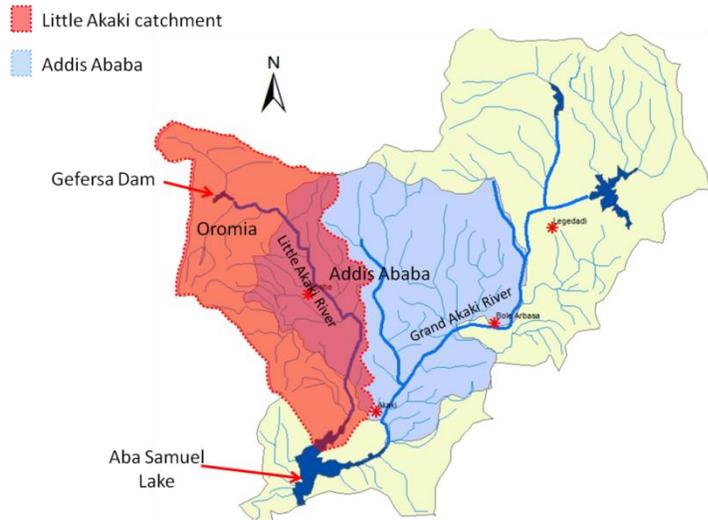


Fig.2 The Little Akaki River catchment (adopted from ZTS, 2014)

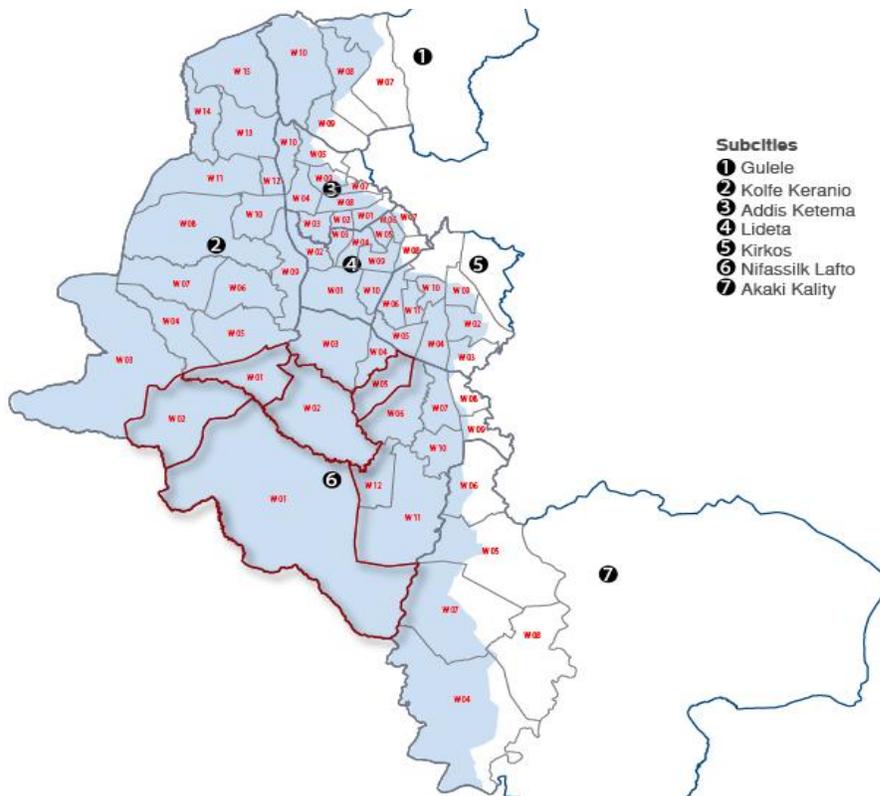


Fig.2 Sub city and wereda administrative divisions within the Little Akaki River catchment

There are four types of green space in the Little Akaki river catchment of Addis Ababa. These are mixed forest, plantation forest, riverine vegetation and urban agriculture. Together these four land uses account for a total of 5401 hectares of land which is 40 % of the total watershed area within the city.

Along the Little Akaka catchment, different types of livelihood activities which are directly or indirectly dependent on green spaces are conducted. These activities include growing crops, vegetables, fruits, flowers, grass and tree plantation, livestock rearing (milk cow), handicraft making from riverine trees). These green spaces are managed and operated both at individual level (at homestead) and at communal level by cooperatives.

Rain-fed and irrigated agriculture is the common features in the catchment. Field crops (wheat, Barely, Teff) are cultivated during the rainy season (June to August) and vegetables and fruits are cultivated using irrigated water from river either using gravitational force or motor pumps.

There are a number of people organized in cooperative, who drive their livelihood from urban agriculture along the Little Akaki river bank. These groups include urban and peri urban agriculture cooperatives and individual farmers producing vegetables and crops and those who are engaged in livestock rearing in different parts of the catchment. They have experienced intensive pressure due to settlement expansion. In general, the high population growth and the dynamic socio cultural mix with divergent experiences, values and interests which complicates the process of organization of users of local water and green resources for common goal is a challenge leading to competition for resources (land, water and green) and putting more pressure on the natural resources as well as both on crop and livestock based livelihood within the catchment.

The land use and land cover of the catchment is dynamically changing through time especially intensified in recent decades. Large scale condominium housing development has taken place in a number of areas, major road and railway construction

is also being undertaken within the catchment. Major water and sewer projects are also undergoing in the catchment that includes the expansion of the Kality sewer treatment plant. Wide range of private investments were also undertaken in the catchment, like construction of commercial buildings, residential houses, real estate development and industrial zones are all included in the catchment. Establishment of new industrial village in Sebeta and Burayu towns (located within the upper catchment) boosted the status of the towns to become the leading industrial towns among the Finfine Surrounding Special Zone of Oromia region. In contrast, the poor institutional capacity to inspect, control and enforce environmental standards is to be mentioned that resulted to increased river pollution.

Especially the constructions of new outlets to Ambo, Sebeta and Bishoftu have boosted the construction of buildings, investments and settlement expansion within the catchment. Major inner city urban renewal projects like Lideta, Tekle Haimanot and part of Senga Tera renewal projects are to be mentioned that were conducted within the catchment. The construction in the outskirts of the city neighbouring Sebeta and Burayu towns took place mostly through conversion of farm land .

The Koshe solid waste dumping site of the city is also located within the catchment. Leachate coming out from the dumping site is discharged to the nearby creek which flows to Jemo River, a tributary river joining to Little Akaki affecting the quality of the river water and groundwater and posing hazardous threat to downstream water users. In this regard, the ongoing closure and reclamation project which is being conducted by the City Government is commendable.

Water shortage is manifested in different localities of the catchment (e.g. Hana Mariam and Karakore localities, Kolfe-Keraniyo sub city wereda 4 within the upper catchment of Jemo River ...etc), river pollution and landscape degradation due to quarrying and cultivation on steep slopes are the environmental problems manifested in the catchment. Contrary to this, the establishment of the Gulele Botanic Garden covering 700 hectares of land on located at the upper catchment of the Little Akaki River is a

commendable endeavour by the city administration of Addis Ababa in the conservation of the mountainous vegetation and landscape of the city.

Similar to the dynamic changes of the biophysical situations of the catchment, dynamic social and demographic changes have also taken place through time, which particularly intensified in recent decades. Just a century ago, there were agro-pastoralists of Oromo people settling in the Little Akaki River catchment. These indigenous settlers had their own cultural practices and norms to manage water and green in the catchment. Now there are wide range of ethnic groups living in the catchment with divergent experiences, values and interests with regards to water and green space. Alongside with the mentioned social and demographic change the human interaction and relations with the environment has also changed. In general, the social and demographic changes within the catchment are one of the major driving forces that have influenced the biophysical change. The other factors are institutional factors that include policies, programs, projects and institutional capacities, and also climate change as abiotic factor which has also influenced and contributed to the biophysical change within the catchment.

2.2 The Mbezi River catchment, Dar es Salaam

The Mbezi River catchment area is the catchment selected for WGA project activities. The terrain of the area is generally broken, with several small and big valleys as well as plateaus. Besides, most the upstream areas experience severe shortage of water supply for domestic and other uses.

The overall physical characteristics of the case study area vary remarkably. The upstream area comprises broken topography with several valleys and plateaus, with a gradient of between 7.7 and 9.7 percent. In total this area measures 3649 hectares. Owing to unregulated house construction activities, most of the inhabited land upstream has been transformed, with several housing clusters built very close to the stream. However, as one moves downstream, moderate gradients and relatively fewer houses area noted especially close to valleys. An area measuring 379 ha which lies in between

the upstream and the downstream has a gradient of around 5 per cent. Sections of the river banks which fall in between the upstream and downstream comprise open sandy soils, with little vegetation cover, and are therefore eroded. Other downstream areas especially along the river are generally flat with gradient of about 0.8 per cent. However, its immediate surrounding areas comprise gently sloping areas with gradient of 1.5 per cent. The densely built up downstream area (incl. Kawe Mnyamani settlement) cover about 379 ha, out of this, Kawe Mnyamani settlement measures 155 ha. The catchment area beyond the Mwai Kibaki (Old Bagamoyo) Road comprise a generally flat area beyond which the River Mbezi discharges its waters into the Indian Ocean.

Field crop (crop cultivation), mixed farming (cultivated crop and bush), riverine vegetation, horticulture and marshes/swamps and rivers are the green space found in the Mbezi River catchment.

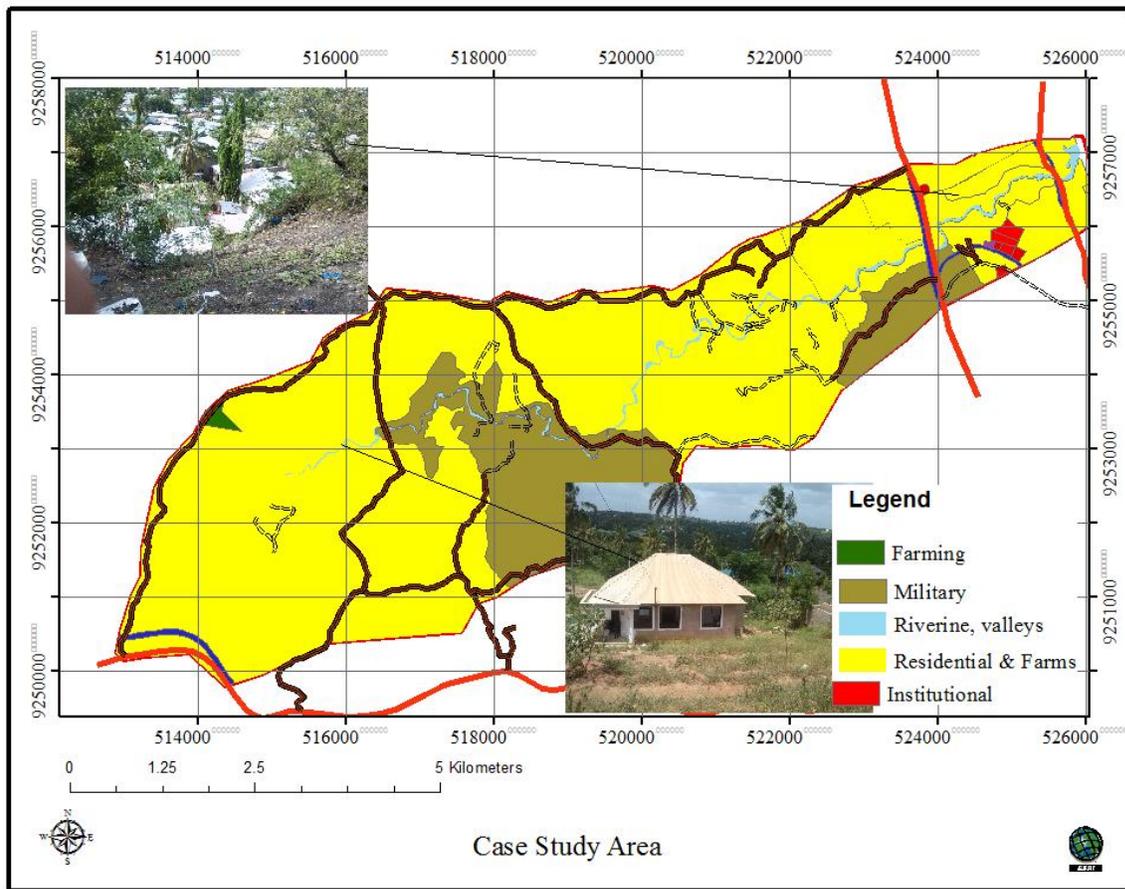


Fig. 3 Mbezi River catchment

2. Description of case sites

The livelihood assessment study was conducted at the Repi Hill (upstream), Jemo (mid stream) and Mekanissa (lower stream) case sites along the Little Akaki River catchment of Addis Ababa (Fig. 2) and at the Kawe Ukwamani (downstream site), Goba Kibululu (middle stream) and the Mbezi Luis (upstream) of the Mbezi Rive catchment (Fig. 3) in Dar es Salaam.

2.1 Addis Ababa case sites

Repi pilot case site is located on the slope of the Repi hill. In the past two decades the hill side was sub divided and invaded successively through informal subdivision. Settlements mushroomed on the steep slope of the hill. Individual single storey buildings were built by the settlers. Some part of the hill is still covered by forest and there is also grazing land in the upper part of the hill. Quarrying has also been conducted on the hill for years, which was used for extracting road construction material until recently. There are also farmers at the top of the hill growing and producing crops for selling and for own consumption. The farming is a major source of livelihood for these people, whereas few settlers from the mid and lower slope of the mountain grow vegetables in their own backyard and use for their own consumption.

The Jemo case site is found adjacent to the Jemo and Hurbu rivers. Before current development, the site was swampy mostly used for livestock grazing. At present large scale condominium housing is the characteristic land use of the area. Condominium blocks five story buildings clustered in group in a compound where communal facilities (open spaces, parking area and communal buildings) are provided. The WGA case site is called Birhu Tesfa House Owners Cooperative Association and is found close to Jemo river. There are also individual farmers and organized groups in micro and small enterprises (MSEs) working along the river bank outside the condominium compound.

Mekanissa case site is located on a flood plain of the Little Akakai river. Unlike major part of the river segment, the water level of the river at Mekanissa site is close to the ground level which easily swells and inundates the nearby areas seasonally. The dominant livelihood activity in Mekanissa case site is farming where the members of the Mekanissa Gofa Vegetable Farmers Cooperative produce vegetables using river water for their own consumption and for selling. livelihood depend. In addition to Mekanissa Gofa Vegetable Farmers Cooperative there is also Mekaneyesus Evangelical Seminary which is located to the opposite side of the Little Akaki River. Education and church services are provided by the Seminary.

2.2 Dar es Salaam case sites

Comparing the population densities in the three areas, Mbezi Luis and Kawe Ukwamani areas are generally more densely built or more consolidated than in Goba Kibululu. This is interalia because of the better landform (gentle slope) which is better suited for setting buildings and providing access system than the broken topography that characterizes the other areas. Kawe Ukwamani has particularly densified because of the location and easy transport link with areas such as Tegeta, Mwenge, Mikocheni and Mbezi Beach. The high demand for rental accommodation has given rise to extension and in-fills in the area.

All the three settlements being informal; the development of housing and other land uses is taking place without a plan or guidance by the public institutions responsible for land management such as the Kinondoni Municipal Council. According to the field studies conducted in the settlements, housing conditions in the upstream and mid-stream sites are generally of better quality than those in KaweUkwamani, suggesting that the two areas are occupied by households with higher incomes than KaweUkwamani. The latter appears to largely comprise lower income households; with only few middle income households. Typical of most low income informal settlements, the area is also densely built; almost all houses are detached single storey. Like many

other densely built informal settlements, most houses in downstream KaweUkwamani area also accommodate informal income generation activities such as retail shops, food and vegetable vending, small repair workshops, tailoring shops, small electronic shops, etc.

Looking at the terrain, a significant part of Kawe Ukwamani is located on low-lying flood prone area. A riparian zone (Mbezi River) measuring about 15-20 meters wide constitutes the main flood plain, that borders this area to the North and North-East, the river has been continuously widening due to soil erosion. In recent years, the River has tended to shift its main course after almost every heavy rainy season. During such periods, floods and soil erosion often give rise to severe adverse impacts including loss of life, destruction of green structures and properties. Despite the flooding, the low-lying area has been rapidly densifying due to intensification of house extension and in-fills. In most areas houses are built very close to the river banks, many are less than 5 meter from the banks of the Mbezi River. Most of the houses close to the river are under increasing threats due to soil erosion, raising water level and frequent floods.

Although is fairly sparsely built, it has high potential for rapid housing consolidation. This is likely to happen especially after the construction of the all weathered road linking Mbezi Mwisho along Morogoro Road and Masana along Bagamoyo. Owing to fairly dense vegetation cover including grass and tall trees, the profile of the river in this area is more stable without significant shift during rainy season. According to the respondents, the quality and quantity of water flowing in the River Mbezi has been diminishing year after another, primarily due to intensification of human activities further upstream. Some of the activities which were reported to cause water quality and quantity deterioration includes increase of brick making, poultry keeping and gardening activities along the river.

Mbezi Luis is located Upstream, and is a confluent area where the three Sub wards of Makabe, Goba and Mbezi Luis converge. The soils in this area comprise fertile black-alluvial soils which are suitable for and have attracted cultivation of various types of

vegetables. In this area, the profile of the Mbezi River is wider than other areas. Intensive human activities all the year around have reduced the vegetation cover and thus increased storm water runoff, leading to the widening of the River.

3. Data collection methods

The unit of analysis of livelihood from green space was both at household and community level. At household level Importance of livelihood activities from green space with respect to food security, income generation and societal integration were considered. At community level the contribution of livelihoods obtained from green space in terms of income generation, social bondage, knowledge and skill sharing and institutional strength were studied.

For collecting data on livelihood from green structure, household interview, focus group discussion (FGD) and transect walk were conducted in each of the three case sites in Addis Ababa and Dar es Salaam. The data and information collected focused on household type, community groupings and activities, livelihood type and importance of livelihoods derived from green space both at household and community level, impact of flooding on livelihoods, local coping mechanism to flooding, water shortage and its impact and local coping mechanisms to water shortage.

3.1 Household interview

Addis Ababa

At Repi case site there are three traditional social organization called "Edir" which provides community service during mourning and in time of crisis. The household survey was conducted on selected members of two Edirs. Out of the 343 households which are organized in the two Edirs, 52 households (15%) are selected through random sampling.

At Jemo case site, the Biruh Tesfa Condominium House Owners Cooperative was considered for the household survey. Out of the 316 households, 50 households (15.8%) were interviewed.

In the case of Mekanissa, the members of Mekanissa-Gofa Urban Farmers Cooperative were considered for the household survey. However, the Mekanissa Farmers Cooperative farm stretches more than 8km length along the Little Akaki River and is located in seven different administrative districts (Wereda). The farms in Wereda 5 are selected for the household survey. This is where the Cooperative office is also found. Out of 85 households 12 were selected for household interview.

4. Findings

4.1 Major livelihood activities

Addis Ababa

In Repi the employment of majority of the residents is in the informal sector. Among the informal sector many household heads and members of the household are working as daily laborer in the manufacturing and construction sector and petty trading. Therefore they have intermittent income. However, there are also household heads and members of the household that are engaged in the formal sector who have got a regular income. Likewise, there are distinct gender role in which the household data shows that predominant women are household wives who are taking care of household chores. Even those who supplement the household income by working in the formal or informal sector have double responsibility which includes taking care of the household chores. Women are also engaged in gardening. Another burden of Repi women is fetching water for household consumption, which is the daily livelihood challenge mainly faced by women. Men are however the main breadwinner of families in the Repi area.

In Jemo residents have diverse occupation and employment. Predominant employment and occupation of the household heads and members of the household is in the formal service sector. Among the service sector most are engaged in trading. However, there are some residents who are engaged in the informal sector working as daily labourer and in petty trading. There are also few households that are totally dependent on remittances obtained from family members residing abroad. Overall, there is a distinct

gender role in terms of employment in which case many women residents are household wives having responsibility to take care of household chores. Gardening in the compound and on the balcony and inside houses is practiced mainly by women. Nonetheless it is to be noted that there are also men who share the burden of household chores of their wives.

In Mekanissa the predominant occupation and employment of the household members of Mekanissa-Gofa Vegetable Farmers Cooperative is vegetable farming. However, there are a number of members who are engaged in secondary sector particularly in garage. This is because garage activity has long been there in the locality (specifically known as Gofa) as one major employment sector which has influenced the occupation of a number of families of the members of the Cooperative who were raised in the specific locality. Comparatively less number of families of the members of Mekanissa-Gofa Vegetable Farmers Cooperative is engaged in the service sector. Major source of the Mekanissa-Gofa Vegetable Farmers Cooperative community's income is farming and therefore the livelihood of the community mainly depends on vegetable farming.

Along the river side of the Little Akaki River, tree and ornamental plants nursery sites are established by young men and women organized and established micro and small scale enterprise. The enterprises sell tree and ornamental plant seedlings to users who like to establish gardens in their plot and communal green space. Therefore the activity, in addition to becoming an important source of livelihood for many individuals, has guaranteed a continuous supply of seedlings throughout the year.

In the Mekanissa area, there is a religious institution called Mekanissa Evangelical seminary which is involved in theological teaching, prayer and preaching services. The seminarium rests on 16 ha of land, of which a considerable part is open/green area. The seminarium has had suffered seriously from river flooding and the seminarium administration has been and is still struggling to overcome this problem. In addition to erecting new buildings with raised ground floor, retaining wall construction, raising of

ground level in some selected areas and planting of vegetation and trees are among the most common activities so far undertaken.

Dar es Salaam

The major livelihood activities in Mbezi Luis, Goba Kibululu and Kawe Ukwamani Sub-ward areas is petty trading including food and vegetable vending; block-making, gardening, operation of retail shops, bars and restaurants; livestock keeping, and carpentry. Most of these are subsistence activities which take place during day time, except for businesses like bars, restaurants and retail shopping which run still late in the mid-night. Both males and females are involved in these activities. However, activities such as carpentry and block making are dominated by men where as food and vegetable vending is largely carried out by women. Other livelihoods activities include poultry keeping, cattle keeping (zero grazing). Few households keep pigs and goats.



Plate 1 Vegetable gardening in Goba Kibululu sub-ward



Plate 2 Block making in Goba Kibululu sub-ward

Table 1: Livelihood activities in Mbezi Luis, Goba Kibululu and Kawe Ukwamani

Area	Livelihood activities	Location within settlement/plot	Remarks
Goba Kibululu	Gardening	Carried out on small lots along the Mbezi River.	Some residents are involved in vegetable gardening in the area owned by the TPDF-Lugalo Military Barrack. Permission was granted by the Barracks officials.
	Selling water from (deep) boreholes.		Bore holes are owned by private households.
	Block making	Often adjacent to River Mbezi – on small incidental open areas. Most of these are small scale activities.	- Mostly undertaken by young men. - One of the activities that requires large amounts of water especially for curing and mixing sand/cement.
Mbezi Luis	Household chores	Within individual compounds.	Most women are dependent on their male spouses; but they also contribute to livelihoods in terms of household chores and taking care of the young and elders.
	Food vending and livestock keeping	- Most food vending is conducted at areas where there are other income generation activities; along the streets. - Livestock keeping takes place within compound. Most households keep between 3 and 10 herds of cattle.	Firewood for cooking is freely accessed from the forest held by the Military barracks.
	Poultry keeping, gardening and water vending (borehole)	Within individual compounds. Most people keep between five (5) and twenty (20) chicken.	This is common activities in upper and mid-stream areas; because in these areas, there are still large open areas where such activities can be accommodated.
Kawe Ukwamani	Food and vegetable vending	Takes place near other livelihood activities and along the main streets	Depends on water from water vendors; women are mainly involved in food and vegetable vending. Most of the food outlets are small and engage only one person. The income per individual per day was approximately TShs. 20,000/=25,000/= per day. Vegetable vendors earn about TShs 20,000/= per day.

4.2 Household livelihoods and the link with green structure

Addis Ababa

In Repi case site 75% of the respondent households have their own small garden in their compound (refer to table 1). Out of which the lion share (78%) of the households with a garden produce food for their own consumption while only 2% of them produce food for selling to generate income. The individual plot sizes of the households vary from 105 to 515m². Most households have 200m² of plot which also include their homestead gardens where they grow vegetables, fruits and maize.

Around 25% of households grow false banana, whose leaf is used for baking bread and the root is used for making a food locally known as “Kocho”. About 20% of the respondent households grow and use medicinal plants and the same proportion of households grow and uses herbs for preparing tasty food and drinks. Comparable number of households plant trees in their garden for shading purpose and to get clean air. Almost 27% of the respondent households use fuel wood from their private garden or collect from the nearby forest. Few numbers of households are doing gardening as a hobby and for visual pleasure or for beauty and also the household survey shows that only 8% of the respondent households have flower pots at home. Though no one from the respondents mention about the use of the local open space as a playing field for children, while conducting the transect walk it was observed that local children are playing on the local field.

On the other hand, 20% of the respondent households rear different kinds of livestock (dairy cattle, sheep, goat and poultry) at a small scale and either feed them from their own garden (poultry) or take their cattle to the nearby grazing land. Majority of the residents have farming skills, because of their rural background. However, because of severe water shortage some have abandoned gardening while others are discouraged by the situation and thus could not seriously take care of their garden. In fact there is much potential for home gardening because each household has enough plot size and many have got farming skills and experience. However the shortage of water is a

stumble block for doing gardening at home and for supplementing food needs and for ensuring food security at household level.



Plate 3 Ornamental plants in Jemo Biruh Tesfa condominium



Plate 4 Home garden vegetable production in Repi

In Jemo (the middle stream case site), almost 50% of the households have flower pots and planter in their houses or on the balcony in front of their house, whereas 14% of the households do gardening on the common open spaces. Only 6% of the households grow edible plants and vegetables for their own consumption. No one from the residents is producing food for selling to generate income. About 14% of the respondents of the household survey grow and use medicinal plants and herbs. There is use of fuel wood for energy in the condominium.

As per the household survey for the predominant proportion of the households (38%), the local green areas are used for playing children and for socializing and recreational purposes which give visual pleasure, beauty, shade tree and sense of place for the residents.

The household survey and the FGD with the Executive Committee of the Association indicate that residents living in the downstairs (especially those in the ground floor) have better access to the common open spaces than those living in the upstairs. It is easily accessible and safe for small children living in the downstairs than those living in the upstairs to go to and use the common open spaces and also easier for their parents to watch them.

In Mekanissa case site, the area of the residential plots of the members of the cooperative farmers ranges between 83-1138m². In addition to that on average each member of the farmers' cooperative has 1400m² plot of farm land which is located at the bank of the Little Akaki River. 63% of the economically active members of the households have farming and irrigation skills, while 40% of the economically active members of the households' primary occupation is farming. All households produce food for own consumption and for selling to the market which is the primary income and livelihood of the community. The households grow and produce more than 54 types of fruits, vegetables, medicinal plants, herbs and spices. Besides vegetables, false banana is found commonly in every household farm which is the typical staple food of the community. Only 17% of the households rear small scale livestock (dairy cattle and sheep). The animals dung is used for fuel and for preparing compost which is to be applied in their own farm.

Overall, the livelihood of the farmers in Mekanissa case site depends on the income and product of the farming activity. In fact on the basis of the household survey and the FGD the livelihoods of majority of the households exclusively depend on the farming, but for all members their primary income and source of livelihood is farming. There are also Micro and small scale enterprises (MSE) engaged in nursery and selling of flower and ornamental plants whose primary income and livelihood is directly linked with green structure.



Plate 5 Vegetables commercial farm in Mekanissa



Plate 6 Small scale gardens in Jemo condominium backyard

In general, in Mekanisa there are diversified use of local green farming and production of food for household consumption and for selling (commercial farming), planting and nurturing trees for fuel wood (used for cooking), protection of flooding and soil erosion by planting soil erosion resistant plant species, planting of bamboo, elephant grass, sugar cane to filter pollution from the irrigation canals, which is also used for feeding livestock and the animal dung from the livestock rearing in turn used for energy and for compost. On the basis of the FGD, the current generation of farmers has adopted farming and irrigation skills from their parents who have passed the skills and techniques that they have acquired from the previous generation and further developed through the practice. In addition, the farmers have been trained by a local NGO in the preparation of compost and other farming techniques and were provided with highland fruits. Most of them have close links and networks with their rural relatives, which also contributed in sharing experiences and knowledge.

Table 2. Summary of the household survey on the type of uses of the local green structure for the households of the three case study areas of Addis Ababa

	Addis Case site		
	Repi	Jemo	Mekanissa farmers cooperative
Total No. of respondent households	52	50	12
No. of households doing gardening and farming	40 (77%)	25 (50%)	12 (100%)
No. of households producing food for own consumption	31 (60%)	3 (6%)	12 (100%)
No. of households producing food for selling	1 (2%)	-	12 (100%)
No. of households growing ornamental plants in flower pots & planters	4 (8%)	25 (50%)	4 (33%)
No. of households growing and using medicinal plants	10 (19%)	7 (14%)	5 (41.7%)
No. of households using local trees for shading & to get clean air	10 (19%)	4 (8%)	4 (33%)
No. of households using local trees for fuel wood	14 (27%)	-	9 (75%)
No. of households doing gardening as a hobby & for visual pleasure	9 (17%)	22 (44%)	-
No. of households that rear livestock	8 (15%)	-	2 (16.7%)
No. of households that uses the local green for playing children	-	19 (38%)	-

Dar es Salaam

Livelihood activities derived from green structures including open green areas are critical to individual households and the community as whole. This is in terms of food supply and security, income/employment generation, improvement of the environmental quality and micro-climate, etc. For households whose livelihoods activities focused on gardening, they also use a proportion of vegetables as part of food. One of the respondents from Mbezi Luis area who had a garden within his compound where he grows banana, cassava, fruits (mangoes, oranges, pawpaw, egg fruits, etc.) and coconut explained that he often uses banana, cassava, vegetables and fruits grown on the compound to meet households' food requirements. Some of coconuts are also sold. The respondent added that he has even coconut trees, which earns him between TShs 40,000 and TShs50,000/= after every three months, meaning that he earns between TShs 160,000/= and 200,000/= per year. He has planted various types of trees in different areas of his plot/compound to protect the land against soil erosion and floods. He also shares his knowledge on the land conservation with other community members. He has repeatedly used his green plot/compound to educate and share with other community members about the importance of green structures and benefits he accrues from them. Such engagements and sharing with other community members have helped increase good neighborhoodness among the local community members.

Another respondent from Goba Kibululu who also runs a half hectare vegetable garden along Mbezi River also asserted that he normally meet some of his household food requirements such as vegetables from his garden; his garden is the main source of income. He earns between TShs. 20,000 and TShs25,000/= per day. He grows Amaranth, Mnavu, Tembele, Figiri, Chinese, Spinach, etc. Like in the other case, gardening activities also seem to facilitate good neighbourhoodness and cooperation; people from different walks of life within the neighbourhood and from outside the area visit him to buy vegetables. Often the visitors ask questions about how he manages his garden activities which seems to flourish very well. He asserted that he often spend time to explain and share with them his skills/experience.

Asked about who in the family are mainly involved in the gardening activities, the respondent reported: *“.....In my gardening activities which I have been operating since year 2009, it is me and my wife who are involved. My wife’s roles are, watering vegetables, taking care of the gardens (weeding and applying fertilizer) and selling vegetables to whole buyers as well as individual households who come to buy directly at my garden. On the other hand, my roles are buying (vegetable) seeds, fertilizers and pesticides; planting, applying pesticides and vegetable vending”.*

Asked about his major worries or threats to his gardening activities which seem to provide crucial livelihoods (employment and income opportunities), he noted: *“.....My biggest worry is the shortage of water from the river, which is my only source of water and survival of my gardening activities. Water has been decreasing continuously from year to year, especially during dry seasons. I believe this situation is caused by excessive sand mining along the river. If this problem persists, I am afraid that we will reach a time that I will not be able to cultivate at all, especially during dry seasons”.*

Further, probing on what are the feelings of the gardener/respondent about how to improve water for gardening and improvement of green structure in the area, he noted: *“.....I urge Mtaa leaders and Police officers to be more strict in monitoring and prohibiting sand mining activities along the river. If this is successfully done, it will somehow solve the problem of water shortage in the river; and we can increase the quantity and types of vegetable cultivated during dry seasons”.*

Table 3: The nexus between livelihoods and water sources & green structures

Household Livelihood	Relationship with water	Relationship with green structure	Remarks
Gardening	Water is used for gardening.	Trees provide shading to vegetables; enhance productivities due to reduced evaporation.	In Goba Kibululu, vegetable gardens are more extensively carried out than other areas. Most of these are in the valleys and wetlands. Often vegetable gardens are surrounded by few trees which provide shade and also break strong winds especially during rainy seasons.
Poultry keeping	Water is used for drinking, cleanness and for animal feeding.	Leaves from plants such as pawpaws, bananas, and sweet potatoes are used to feed cattle/pigs/poultry.	<i>Cannabis Indica</i> is also used by poultry keepers as medicine. The leaves are crushed and mixed with drinking water.
Food vending	Water is used for cooking, drinking and cleanness.	Use of firewood as source of energy.	Food vendors rely on firewood for cooking, some use charcoal. Very few use gas (restaurants and bars) and middle/high income households.
Livestock keeping	Water is used for drinking, cleanness and mixing food.	Used as source of food.	During rainy season, some livestock keepers herd cattle on the green structures in the Barrack area and along River Mbezi.
Block/brick making	Water is used for the preparation, watering and curing blocks/bricks.	Some blocks/bricks are cured under shades.	
Household chores	Water is used for cooking, drinking, cleanness.	Use firewood for cooking; also some outdoor activities (washing/cleaning) take place under trees outdoor.	The use of firewood is common among lower income households; charcoal is widely used among most households. The use of gas is limited to middle and high income households.

4.3 Household livelihoods and the link with local water resources

Addis Ababa

In Repi case site predominant number of households gets access to water for household consumption from communal standpipe. Only 13% have private water tap

connection (refer to table 2). The households with private water connection get water at least five days of a week. In contrast majority of the communal standpipe users get water once every 15days. But there are also households who get water every three days interval from the communal standpipe. It takes 30minutes to 6hours to fetch water from the communal standpipe for these households. Many households also purchase water from private vendors at least once in a week and also buy bottled water for drinking. Households pay 50cents to maximum of 20birr for 20liters of water.

Almost every household (96%) use roof harvesting to supplement water supply during rainy season which is used mainly for washing clothes and kitchen and dining utensils and for cleaning floors, while few households use water harvested from the roof for cooking purpose. There is also small number of households (4%) who uses local stream to supplement household water needs which is used for washing. Few households (2%) who are nearby Jemo River use the river water for watering their garden and comparable number of households collect surface runoff for watering their garden. One Edir organized at the foothill of Repi has developed borehole that supplies to the members of the Edir with 50cents price for 20liters and the same amount of water for 1birr price for non members of the Edir. There is also another MSE established at the foot of the hill to operate and manage communal standpipe, which is selling 20liters of water for 1 birr to the local community. In addition to this, AAWSA is trying to address the problem by providing water using water-tank vehicle at the foot of the hill in Suke locality once every 3 to 4 days during the dry season.

In Jemo case site all households have private water tap connection. However the access to water varies. Few households from the ground floor get water every day and night, while those in the upstairs especially in 4th floor they get water once in a week after mid night. Households pay 5 to 50 birr for water per month. Some of the households buy two liters of bottled water daily for drinking which costs 12birr. Some households (14% of the respondents) collect rain water from the broken downpipe of the condominium building to be used for washing closes and flushing their toilets,

whereas 4% collect and use surface runoff and comparable number of households use river water for watering their garden.

In Mekanissa pilot case site 84% of the households have private water connection. 8% of the households share taps with neighbours and comparable number of households use communal standpipes. The households spend minimum 10birr to maximum 150birr per month to water for household consumption. On average they pay 80birr per month. The communal standpipe users spend 1 to 3 hours for fetching water. In addition to these sources the lion's share of households (83%) collect rainwater from the roof and use it for household consumption. All households use the river water and surface water for irrigating their farm land. In general, the members Mekanissa farmers cooperative use water for different purposes such as municipal pipe water used for household consumption, for livestock drinking, for washing vegetable products and for wetting and preserving products until they reach to the market and the river water used for irrigation, for growing and nurturing seedling and also harvested rainwater used for livestock drinking.



Plate 7 Rain water harvesting in Repi upper case site (Picture by A. Backhaus.)



Plate 8 Hollow concrete block MSE Cooperative in Jemo locality (Picture by A. Backhaus)

Table 4. Summary of the household survey on water sources of households

	case site		
	Repi	Jemo	Mekanissa farmers cooperative
Total no. of respondents	52	50	12
No. of households with private water connection	7	50	10
No. of households who gets water from communal standpipe	48	-	1
N ^o of households sharing pipe with neighbours	-	-	1
No. of households harvesting rain from rooftop	49	7	10
No. of households harvesting surface runoff	2	2	12
No. of households using river water	1	2	12

Source: household survey

Table 5. Summary of the uses of different water sources

Local water sources	Use of the water sources in the three case site		
	Repi	Jemo	Mekanissa farmers cooperative
River water	For watering gardens	For watering gardens	For irrigation
Surface runoff	For watering garden and cement mixing	For watering gardens	For growing seedling
Rainwater harvested from roof top	For washing clothes, kitchen and dining utensils, for HCB production	For toilet flush, for washing clothes	For washing hands, clothes, flatware and utensils, for drinking after boiling, for preparing livestock feed and drink
Pipe water	For household consumption, for HCB production	For household consumption, for HCB production	For household consumption and for washing & soaking vegetable products
Bottled water	For drinking	For drinking	No one mentioned about it
Used water	For watering gardens	For flushing toilets	For flushing toilets

Dar es Salaam

In Mbezi Luis area, access to potable water is a chronic problem especially during the dry seasons i.e. between September and February. During this period most households rely on water from boreholes owned by individuals and from water vendors. Water vendors buy water from household operating boreholes and sell it at TShs. 300/= per 20 litres bucket. They normally buy at TShs 200/= per 20 litres bucket. In total, there are four privately owned boreholes in Mbezi Luis.

There are also shallow boreholes dug by the community members on public open areas in Mbezi Luis settlement. Water from boreholes is generally saline, as a result most households do not use it for drinking. Normally, it is used for cleaning, cooking and washing. Most community members in Mbezi Luis settlement therefore buy potable water for drinking from water vendors at a price of TShs 500/= per 20 litres bucket. On average, a household uses about 20 liters for drinking and 80 litres for cooking/washing per day. This implies that on average, households spend up to TShs 1,500/= on water per day.

Compared to Mbezi Luis area, access to water supply in Goba Kibululu and Kawe Ukwamani areas is not a severe problem. In Goba Kibululu, there is a borehole owned by a private water supplier who supplies water to households through piped system. The proprietor of the borehole has installed water meters to each of the thirty households that he supplies water to. Households connected to this supply system pay on monthly basis according to their consumption. According to interview with the proprietor of the borehole, he collects between TShs 12,000/= and TShs 35,000/= per month from the households connected to the borehole. The borehole owner also sells water to community members not connected to the piped system; but at TShs. 100/= per 20 litres bucket. Access to water supply from borehole was reported to be fairly convenient; when there is no electricity the supplier uses generator to ensure constant supply to his customers. As noted earlier, the quality of water from borehole is not so good; it is slightly saline. However, some households complained that sometimes they cannot use it for drinking because it is saline. They therefore, prefer to buy water for

drinking from water vendors (Dolphin Company) at a price of TShs. 300/= per 20 litres bucket.

Dolphin Company is a private company which supplies water in Makongo, Goba Kibululu and Goba Mwisho areas. It operates with large trucks with built in large tanks (approximately 20,000 litres). According to the interviews with the community leaders, the source of fresh water sold by the Dolphin Company is mainly underground water. The Company has deep wells dug in Tangibovu area.

Asked about whether they were involved in awarding contract to supply water to this company or whether they did negotiate for the price, the respondents noted: “...*No, we were not involved. But it seems that the Company got permission from the Government*”. Dolphin Company started operating in Goba Kibululu since year 2012.

In Kawe Ukwamani Sub-ward area, water supply is not a problem at all; primarily because it is connected to potable water supply system managed by the Dar es Salaam Water and Sewerage Corporation (DAWASCO). Most areas have household connections; and where one is not connected there are various public water points as well as kiosks managed by faith-based organizations. Generally, supply of potable water in the area was reported to be regular.

Table 6: Summary of water sources, areas covered vs. livelihoods support

Area	Water source	Use vs. livelihoods	Remarks
Mbezi Luis	(i) Deep private water boreholes (ii) Small water vendors (iii) Shallow public boreholes (iv) Rain water harvesting	- Source of income (water vendors) - Used for mixing cattle/chicken feed - Used for cooking, drinking, cleaning, washing, etc.	
GobaKibululu	(i) Deep water boreholes (ii) Large private water vendors (Dolphin) (iii) Mbezi River	- Source of income (water vendors) - Used in gardening activities - Used in bricks/block making - Used for cooking, drinking, cleaning, washing, etc.	
KaweUkwamani	DAWASCO	- Cleaning, washing in restaurants/bars - Used by households for cooking, drinking, cleaning, washing, etc.	

4.4 Importance of green/blue structure to community livelihood

Addis Ababa

In addition to household livelihood, green structure also contribute to community livelihoods. In the Jemo condominium in Addis Ababa, like-minded residents pull their force and resource to develop green space for aesthetic, social and recreational purposes. In the Repi site, a grassland area in the mid slope is used as a communal grazing land for those who keep livestock. In Mekanissa urban agriculture, the urban farmers' cooperative hires daily labourers to cultivate the communal land and the income obtained from selling vegetables is used to cover the cost of the cooperatives and to maintain irrigation ditches. Communal tools and resources are used to develop the communal farm .

Dar es Salaam

Green structures in Dar es Salaam provide aesthetic benefit to communities , facilitate inter-community interaction and skills sharing, facilitate social interaction and check floods and improve micro-climate. The blue space enhance site aesthetics and improve micro-climate.

4.5 Household vulnerability to water shortage

Addis Ababa

In regards to vulnerability to water shortage the households at Repi are more vulnerable, where more people are affected by water shortage. The problem is much more severe. The majority of households who get water from the communal standpipe are forced to collect water during night time (after mid night) once in a week if they are lucky, which is inconvenient and unsafe for households. Residents are obliged to queue for long time (4 hours) and sometimes the probability of getting water after these long hours of waiting is slim. Most of the residents are forced to fetch water from far distance location which is also tiresome demanding labour cost. It is also tiresome to get up late

night which consumes much of their time. Because of sleep disorder, their daily activity is affected and thus families face difficulty to improve their livelihood.

There are cases where 2 Jericans (a plastic can with 20-25 litre capacity) shared by six members of a household per day which is less than seven litres per day per capita consumption that includes drinking, washing and other household consumption, which is less than the recommended minimum consumption level 20litres per day per capita. There are households whose members consume less than half a liter per person per day for drinking while normally a person need 2litre per day for drinking. In general, the inability to keep personal hygiene and insufficient drinking of water exposes the families to sickness and diseases.

The shortage of water creates stress in the house work and especially for women to fulfill their obligation and duties in the daily household chores. It consumes much of their time. It is also difficult and stressful for women to leave their babies at home for fetching water. Women are also affected while carrying long distances and climbing steep slopes of the hill which results to damage and injuries and kidney problem due to heavy load. Women carrying heavy load of water everyday are feeling backache (back-pain). The household respondents also mentioned about the problem of quality of water collected from the communal standpipe and because of shortage, household tend to accumulate water as much as possible which in-turn can be degraded when stored for longer time.

All in all these situations have put the residents to health problem and hazard. Households also faced problem of pollution when the pipes are damaged and maintained. The pipe water coming after days of disruption is polluted and children affected. Impurities and suspended materials slip into the pipes and the water becomes turbid. This poses health threat to the households. Health problems are prevalent. Households are forced to buy bottled water for drinking which is incurring cost. In addition, those who tried to sublet rooms find it difficult to get renters that hardly anyone is willing to rent a house in the locality. It is less preferred area by house renters

because of the water shortage. There are some households who are still facing flooding problem.



Plate 10 Long queue of Jericans for water in Repi

On the basis of the household questionnaire in regards to vulnerability of households the most pressing problems in Jemo are water shortage and pollution in the order of priority. In particular, before September 2015 the problem of water shortage was severe. Since September 2015, most respondents said that the problem is reduced but not resolved totally. The residents in the upstairs are more vulnerable and still face problems, due to frequent disruption and gets water once in a week after mid night. Due to low pressure in the pipes still most residents don't get water at all specially in day time. Families forced to wake up late night for checking and filling water and because of this passing sleepless night and being tired which creates stress for watching and checking for water to fill the tankers the whole night. The toilets become stinky when water is disrupted, which needs to be flushed and households find it difficult for using the toilets. In ability to keep personal hygiene resulting to exposure to health problems stomach ache and also stringent smell of the toilet is another problem causing asthmatic problem.

In Mekanissa irrigation water is disrupted when unexpected rain damages the canals. The shortage of water for the farms in turn affects the production and income of the

farmers and their livelihood. During rainy season the irrigation canals are susceptible to flood hazards which become damaged and irrigation water is disrupted also requiring labor for maintenance. Factories that release hazardous effluent to the river are affecting the products (sometimes beyond the natural intake of the plants that filter the river water). The pollution of the river water by the effluent of different companies specially said to have health impact (skin irritation) on the farmers working on bare hands.

Dumping of solid waste by different local business firms (like barberry, butchery ...) and from houses on irrigation canals is blocking the flow of water and affecting farmers' activity. The dumping of cart away and debris into the river bank is also a major cause that increases siltation and sedimentation to be cumulated on the riverbed resulting to increase in flooding incidence.

The above mentioned challenges increases flooding affecting the farms which are inundated during rainy season sweeping all of the farms vegetables and even trees causing considerable damage. It also affects the canals by damaging, clogging and blocking with solid silt, river deposit and sediment. The collapse of the canals in turn blocks the irrigation water flows which then require labour for maintenance, incurring additional cost of labour.

The sprawl of the river flooding also prevents the farmers from farming and production for certain period of time, creating worms that damage the farm and consequently resulting to economic problem due to reduction in household revenue. The farmers also eventually face water shortage for irrigation during the time of collapse of the canals until it is repaired. In general, the collapse of dams and canals has labor, time and financial costs on the farmers. Erosion at the edge of farm land is another serious challenge faced due to increase in flooding.

In general flooding and water shortage is connected in the case of Mekanissa, in which case the damage of canals and dams resulted water shortage for irrigation. Evangelical

Seminary which is located on the other side of the river have built dyke (raising the ground level) to protect the seminary from flooding, on the other hand this measure has increased flooding on the farms which have become depressed area and thus exposing the farms to be more vulnerable to river flooding.

Dar es Salaam

Livelihoods are generally adversely affected by water shortage, especially inadequate, erratic supply, poor quality (saline) or high price paid for potable water. One of the respondents who is a gardener in Goba Kibululu area reported that he is normally adversely affected by the decline of water flowing in the river especially during dry season. This, he argued affects his main source of livelihoods because he depends on water from the river for his gardening activities. During dry season, he cultivates only a certain types of vegetables such as Amarath and Tembele which do not depend on a lot of water i.e. they are bit resistant to drought. Regarding income earned, it was reported that despite decline in water for gardening during dry seasons, generally he earns the same income throughout the year. There is just a slight difference; normally he earns between TShs. 20,000 and TShs25,000/= (10-12USD) per day when there is enough water or during rainy seasons. During the dry seasons, he earns a maximum of TShs. 20,000/= (10USD). According to the discussions with the vegetable gardener, the difference is small because during dry season he raises the price of vegetables as well as decrease the size of the bundles. Normally, he wholesales (vegetable vendors) each bundle of vegetable at TShs. 200 and at TShs. 500/= to individual households. During dry season, he increases the price to wholesale buyers, up to Tshs. 300/= per bundle but maintains the same price to individual households. At the same time, he also reduces the size of (vegetable) bundles. Apart from the small difference in income earned, there were also complaints that shortage of water adversely affects business environment because if there was an abundant and reliable source of water supply one could increase the size of the lots cultivated and therefore earn much more. What also ought to be noted is that, ultimately it is the poorer community members who suffers or pays more for the water shortage in the area. As noted earlier, this is the case with

regard to access to potable water as well as to water required for gardening and animal husbandry activities.

Another respondent in Goba Kibululu who is involved in sand-cement blocks making also complained that he is often adversely affected by water stress. During the interview he asserted that he normally uses tap water from private boreholes. He pays monthly depending on the consumption. But, when there is no electricity, he does not have access to tap water. Then he is forced to buy from water vendors who sells at the price of TShs. 7,000/= per every 1000 litres i.e. TShs 7/= per litre. During dry periods households are charged TShs. 10,000/= per every 1,000 litres. That is TShs 10/= per litre.

4.6 Household vulnerability to flooding

Addis Ababa

Flooding is a serious problem in Mekanissa. During the rainy season, most of the farmland get flooded and the farmers are unable to cultivate and produce vegetables. More importantly the release of water from the Gefersa dam is identified as a major cause of flooding in the area. They have experienced severe flooding especially when water is released from the dam. However flooding is not only a problem to the local farmers, but it is also a resource. They are using the silt from the upstream flooding for their farming which brings nutrients and deposits that helps to nourish the vegetables.

The Mekanissa Evangelical Seminary is also facing flooding problem. The area is situated in flood plain zone. The new road to Gofa (which is adjacent to the Seminary compound) was constructed by filling compacted soil and selected material to raise the level of the road, which in turn created depression in Mekanissa Seminary. Moreover, this new road connection to Gofa and the widening of 'German Square' (traffic roundabout) has conveyed and diverted the stormwater towards the Mekanissa Seminary exacerbating the flooding problem in the compound. Because of this more frequent and severe flooding has been experienced in last ten years period in

Mekanissa area. Previously before the construction of the new road and the bridge the stormwater was distributed to different places, but now it is channelized towards the Seminary area. Additionally, the constructed bridge on the Little Akaki River is narrow and silt is accumulating under the bridge, which is also decreasing the hydraulic capacity of the bridge causing a backflow to the Mekanissa Seminary and to the farms on the other side of the river.

Until very recently, the Repi Hill locality was highly affected by flooding (flash flood) due to swift flow of flooding coming from upstream steep slope.

Dar es Salaam

Vulnerabilities associated with flooding risks appear to be a serious concern in Mbezi Luis and Kawe Ukwamani areas. Households who live close to the river valleys are normally more vulnerable than those who occupy the land away from the river valley. For instance, according to interview with respondents in Mbezi Luis and Kawe Ukwamani areas, several households lost their assets and other properties worthy millions of shillings during the 2014 and 2015 flash and floods in Dar es Salaam. According to the interviews with one of the key informants, in May, 2014 floods destroyed a fence for a house in Mbezi Luis. The owner had to incur high costs to repair it. However, in May 2015 that fence was destroyed once again; this time, the destruction was severe; and the owner incurred a total of TShs. 1.2 million to repair the fence. Another household in the same area (Mbezi Luis) had a toilet destroyed/washed away by floods in April, 2015. The household still shares the toilet with a neighbour.

As expected in the Down-stream area of Kawe Ukwamani, the flooding problem is reported to be more severe. Many houses which were close to the river banks were flooded and foundations destroyed. One household lost part of his house (a room and a toilet); in May 2015. During the field studies, the affected household was still mobilizing resources to repair it. The cost of repairing was estimated at TShs. 10 million.



Plate 11: House destroyed by flash floods in KaweUkwamani settlement.



Plate 12: House destroyed by flash floods in KaweUkwamani settlement.

4.7 Local coping mechanisms to water shortage

Addis Ababa

Households in Repi organized water committee to request the authorities for water connection and contributed and assimilated money to finance the required budget, but only few residents have successfully gained private connection. Other measure taken are fetching water from far distant location and buying of bottled water for drinking, which are taken by those who can afford to do so. In general, the measure taken as a coping strategy at household level is to collect and accumulate water as much as possible and to economize water consumption. Households use barrels and jericans (plastic jugs) to accumulate water. Households also reuse water for different purposes so as to economize their consumption. Majority of the households also harvest rainwater at a small scale to supplement water supply at household level, which is only possible to get during rainy season.

In regards to water quality, households take precautionary measures that includes not to using the collected and stored water specially for drinking when the collected and

stored quality of water is low. In addition, a number of households have water filter locally known as “wuha agar” at household level.



Plate 13 Hand dug well at Repi foothill

In Jemo similar to Repi households, they cumulate water using jericans and barrels, reuse water for different purposes (e.g. used laundry water for flushing) and save water, purchase water from private vendors, purchase bottled water for drinking and also use water filter (wuha agar) for filtering pollutants. Those who have got private car bring water from far distant location. Household in Jemo also collect rain water from rooftop using the broken downpipe.

In the Mekanissa Evangelical Seminary, they started to use deep water well (borehole) pumped from 55meter since 20years . The water is used for various household consumption purposes (drinking, washing and cooking) as well as for construction and staff consumption. However, the level of quality is said to be not ensured by Authorities and there are complaints from students that it causes some inconvenience for those drinking from the well. In total there are 500 people in the institute that uses the water. It is also to be noted that the Seminary has a municipal water connection.

Dar es Salaam

(i) Household level coping mechanism to water shortage

The main strategy to cope with water shortage at household level is buying water from private water vendors (borehole, tanks). Water from borehole is pumped into large overhead plastic tanks. One of the households which happened to be the owner/proprietor of a borehole supplying water in Mbezi Luis area had two water tanks. One had the capacity to store 4000 litres and the other 1000 litres. Water from both tanks is normally sold to water buyers using smaller (20ltrs) containers/buckets. Few households harvest rain water using plastic tanks mounted on the ground and at times concrete block tanks underground. However, large scale rain water harvesting is mainly done by high incomes households primarily because large plastic tanks are too expensive and unaffordable by low income households. Even without large plastic or concrete tanks, most households harvest rain water using small containers and other house-ware at their disposal.

Asked why there is generally little interest or no strong tradition to harvest rain water despite severe water scarcity, the Sub-ward leaders and several other households interviewed in Mbezi Luis noted:

“...It is not that people have no interest in rain water harvesting. Majority of the households living in this area are low income households who cannot afford the gutters and large Sim (plastic) tanks required to harvest rain water. That is why many households just use small containers and other house-ware to harvest rain water”.

Further probing on what they think could be done to increase awareness and get local community members to harvest rain water the Sub-ward leader noted the following:

“...As I pointed out earlier, community members are aware of rain water harvesting as one of the mechanisms to cope with water shortage. The reason why it seems to be still at a small scale is that other means of rain water harvesting such as use of large plastic tanks is too expensive for the majority of households to afford; if they are supported, they will definitely embark on large scale harvesting of rain water”.

(ii) Community level coping mechanism to water shortage

In Mbezi Luis, there is a piped water supply system connected to RuvuChini. This supply source has been operational since year 2010. Most community members seem to believe that piped supply will improve in the future. That is they hoped that when piped water supply (DAWASA) project starts to operate in the other areas, water problem they have been experiencing for decades end. For the time being, they depend on private boreholes and water vendors. Like in Mbezi Luis, there are also shallow boreholes dug by the community; most of these are along the Mbezi River. Most of the water from shallow wells is used for cleaning. There is no specific management or administrative organ to oversee the operation of boreholes. Plates 7 and 8 show some of the existing coping mechanisms to water shortage by households and community in Mbezi catchment area.



Plate 14: Shallow borehole dug by the community in Mbezi Luis water in Mbezi Luis.



Plate 15: Large plastic tanks which individual households to store

4.8 Local coping mechanisms to flooding

Addis Ababa

The Repi Hill locality was highly affected by flooding (flash flood) due to swift flow of flooding coming from upstream steep slope, but after the construction of ditch in the area the problem is largely reduced. The ditch was constructed by the development committee of the wereda which was financed jointly by local community, government and the local Edirs. This might have an impact on the mindset of the community to rely on conventional method for stormwater management.

The Mekanissa-Gofa Urban farmers Cooperative Association support the members farmers to plant erosion resistant trees and plants (such as bamboo, false banana, sugarcane, elephant grass) to prevent erosion. Building terraces is also done to withstand erosion. Dykes are also built at the edge of farms to protect farms from flooding. There are also water committees formed to organize and mobilize resources for maintaining the canals and dams. Farmers contribute money which is collected by the water committees for using it during the time of crises. Rebuilding, maintenance and strengthening of canals and dams are conducted collectively. The farmers also adopted different farming techniques following the slope and landscape. Sand filled sacks are also used and piled along the flood direction and on the dams to increase the height of the dams. The farmers also clean the debris and silt from the canals. In addition, ditches are constructed in some locations to protect the farms from flooding. The farmers also halt cultivation and seeding during the time of flooding and irrigation water shortage.

In regards to pollution of the river, the farmers let the highly polluted water to flow until the high concentration of polluted water passes and better quality of river water appear in the canals. Planting of trees like bamboo and sugar cane along the edge of the farms so as to filtrate the pollution, which is a biological filtration technique/method applied. They also put small check dams to filter the solid waste, silt and debris from the canal as well as to sediment pollutants.

The farmers also adopted as a coping strategy by diversifying their income and livelihood. Significant number of the respondents has other nonfarm revenue so as to complement the household income and to sustain the family income and livelihood during loss of revenue from farming.



Plate 16 Sand filled sacks piled as a flood protection in Repi

As a coping strategy the Mekanissa Seminary has connected storm water and liquid waste discharge to the Little Akaki River. Non return valve was installed with the connecting pipes for protecting and blocking back flow of water from the River. However, the pressure of the back flow water was beyond the capacity of the valve, which over flooded during heavy rain and destroyed properties in the compound. Because of this they are forced to demolish a kindergarten which was located within the flood affected spot. They have also built gabions, earth dam and dyke to protect the compound. They are doing various efforts and devising coping strategies as a trial and error and learning process on how to cope with flooding.

Dar es Salaam

At community level, the coping mechanisms observed are planting of various types of plants (i.e. trees and grasses) along the river course and in open semi-public areas. Piling sand bags along the river crossing was common during rainy season. In Kawe Ukwamani trees and grasses were also planted along the river course by the

community under the coordination of the Mtaa leaders as one of the mechanism to check flooding. Local coping mechanisms by households and community in Mbezi Catchment Area are also illustrated in Plates 3-6.



Plate 17 Various plants planted and sand bags piled along the Mbezi River course.



Plate 18: Trees and grasses planted within and outside the households compounds in Mbezi Luis.



Plate 19: Sand bags piled around foundation flow into of the house in Mbezi Luis



Plate 6: Strong wall built to block water the house in KaweUkwamani.

5. Assets for implementing LSM at the Jemo and Mbezi River catchments

Both in the Jemo and Mbezi River catchment, there are different assets that the residents have been utilizing for their livelihood. It is important to identify these and their role in landscape based stormwater management.

5.1 Natural capital

The natural capital in Repi case site of Addis include household garden, forest in the surroundings, and borehole water. In the Jemo site, vegetable garden is the natural asset that contributes to household food supply. Communal green spaces provide space for recreation, socializing and as children play ground. In the Mekanissa vegetable farm, the farm land and river water are the major natural capital for driving livelihood by the urban farmers.

In the Mbezi Luis, Goba Kibululu and Kawe Ukwamani have access to water, natural features in the landscape and green spaces of the catchment area which they use for their livelihoods. These include river, groundwater and rainwater, both private, public and institutional green spaces, and the trees, grasses, and vegetables plants are the natural capital.

5.2 Financial capital

In the Repi and Jemo case site, the primary financial capital is the personal savings of households. In the Mekanissa farm, in addition to personal finance, "Equib" (an indigenous financial institution where members contribute money that revolves amongst themselves to start or enhance business) and the running capital of the farmers' association are the financial capital used for driving livelihood from urban agriculture.

In the Dar es Salaam case sites, the existing livelihood activities are key sources of employment and income generation that are sustaining most households who would otherwise find it difficult to survive. Those earning largely regular incomes, own retail stores, cafes and bars and many of them are found in Kawe Ukwamani where natural resources such as open spaces/land for farming is less available.

5.3 Human capital

Knowledge and skill of women, men and the youth in gardening, vegetable farming, water well drilling and pumping water up. Water well drilling is the task of men, and the youth and the women take part in gardening at homestead level in the Repi site and on the balcony and on communal open space in Jemo condominium. In the Mekanissa farm, both men and women are investing their skill and knowledge for the production and eventual selling of vegetables and fruits.

In Dar es Salaam, some of the livelihood activities appear to be gender specific such as brick-making or sand-mining; frying chips (French fries) which are mainly done by men and vegetable farming which is done mainly by women. The gender specificity cuts across the three study sites on the Mbezi river catchment. Many actors (men) involved in craft-related livelihood activities such as brick-making have learnt their skills by “doing”. This is mainly because most respondents asserted that the nature of livelihoods does not require formal training, the activities are conducted on small incidental open spaces and someone looking for a unskilled job can stop by and inquire, once they are hired they are taught the trade. Informal knowledge sharing was also observed whereby individuals with long term expertise in the craft e.g. poultry –keeping, gardening would pass on the skills to interested neighbors. Abundant human capital (semi-skilled) in the form of youth exists in all the three case sites in Dar es Salaam. A receptive community means that individuals may be open to learning new ways related to their livelihood strategies such as LSM.

5.4 Social capital

In the Repi case site, "Edir" and "Equib" are the common indigenous associations which are formed by communities of a certain area. Both of them are welfare institutions which support their members financially in time of funeral mourning (Edir) and business start up. Members of the "Edir" have dug well in Repi for use by the local people in time of water shortage. In the Jemo case site, Condominium owners' association is an important social asset that has been used in the greening of open spaces in the condominium site.

In Dar es Salaam, while many livelihood activities operate at household/individual level; there is every day interaction because the activities depend on contact as well as networks. Households sell vegetables, food, water etc to their neighbors and build rapport while sharing information. Learning, sharing and mutual support are engendered by the livelihood activities. Group/community activities are intermittent and are reported to be intense during crisis such as flooding. The primary individualized and household level activity maybe foreseen as a challenge to the introduction of large-scale activities in the LSM endeavor however the community in low income informal are known to possess stronger social capital that can be harnessed through community-based organizations to achieve mutual benefits. However not all study sites are similar in terms of the social capital available, Kawe Ukwamani appears to have a more interconnected community possibly because it comprises high densities and people live in proximity to each other.

5.5 Physical capital

There are asphalt, cobble stone and gravel roads in the Repi site which provide access to the green spaces in the surrounding, to dip well site, to market, school and local administration. From the perspective of LSM, the dip well and pipe water are important sources which the households use, not only for household consumption, but also for gardening. In the Jemo condominium, cobble stone roads and pipe water are the major physical capital that are related to LSM.

The Dar es Salaam case sites are generally poorly endowed with physical capital; the roads are poor especially in Mbezi Luis and Goba Kibululu. There is hardly any water supply system hence the water shortages. This has grossly affected livelihoods and overall well-being of localities. Often community members have to pay dearly for potable water thus placing additional burden to their incomes and savings. The absence of stormwater drains exacerbates flooding during heavy rains; while this affects the community, the weakness can be transformed into strength in terms of receptivity to sustainable methods for storm water management at household and at local government levels.

6. Conclusion and recommendation

In both the Jemo River and Mbezi River catchments, the importance of green and blue structures in providing livelihoods for local communities cannot be underestimated. Most of the benefits are related to household level benefits, such as vegetable and fruit production, and benefits related to the use of water for petty businesses such as brick making, and gardening for beautification. These economic benefits are opportunities for implementing landscape based stormwater management in the two river catchments. The current flooding problem during rainy season and scarcity of water in the dry season are also opportunities for implementing landscape based stormwater management.

The livelihood study in both the Jemo and Mbezi river catchments has shown that the local green spaces and water bodies provide livelihood to a considerable number of households. In addition, the information obtained also showed the use of the green spaces for recreation, socializing and to mitigate temperature increase. The economic and social benefits that residents of the case sites of Jemo and Mbezi river catchments are enjoying are there because the households/communities have developed or conserved green spaces. For low income households and communities, economic benefit outweighs the environmental benefits that could be obtained from green spaces. Therefore, the local stormwater management strategy for the two river catchments should build on the existing economic benefits and provide additional options where green space development and management for the purpose of reducing stormwater runoff should be able to enhance the economic benefits of communities and households.

Effective green space development for stormwater management requires engaging a wide range of communities, developing a common vision of economic and social benefit, and developing a local green space development and implementation plan. Since financial subsidy for stormwater management may not be there, effective stormwater management plan using green spaces should assess the livelihood assets and aims at providing multiple economic and social benefits to households and communities..

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