

# Engagement of Decision Makers for Improved Management of Shared Resources for Enhanced Community Benefits and Adaptation to the Changing Climate in Tana River Delta, Kenya

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## Research Article

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### ABSTRACT

Tana river delta is a key biodiversity hotspot in Kenya inhabited by pastoralists and agriculturalists. Inadequate land use planning, competing land uses, uncontrolled grazing and increasing crop farming have been major sources of conflicts resulting from competition for water, pasture and settlement. This study assessed; the contribution of delta resources to household wellbeing, stakeholder perceptions on formal management of the delta resources and how best stakeholders would be integrated into land use planning. This survey was done through Participatory Rural Appraisal tools and administering of household questionnaires. The findings revealed: new livelihood sources are emerging, a high number of poor households; livestock is owned by households living in and outside the delta with the non-delta livestock owners having the largest herds. Under-explored alternative livelihood sources, failure to target decision makers and insecurity presents major challenges to sustainable management and utilization of delta resources. Peaceful co-existence and sustainable resource use is attainable through participation of farmers, livestock owners (decision makers) and the herders (decision implementers) as the latter are frequently replaced, and have less power and decision making authority on delta resource use and access. Effective land use planning require active engagement and awareness creation of all stakeholders, enhanced capacity of committees/stakeholders

and formation of an inclusive delta resource management organization.

## **INTRODUCTION**

Global climate change is currently a major threat to humanity. At the regional level, numerous long term climatic changes have been observed. They include the widespread change in precipitation amounts and distribution of ocean salinity, wind patterns and aspects of extreme weather resulting to droughts, heavy precipitation, heat waves and the intensity of tropical cyclones. These changes threaten community livelihoods, food security, economic sectors, ecosystems and social groups<sup>[1]</sup>. Local communities are experiencing significant climatic change impacts on food supply and security, water availability, infrastructure and agriculture income. Vulnerable populations are likely to become more vulnerable if structures are not put in place to proactively address challenges of climate change thus efforts are increasingly being made to enhance community adaptation to climate change. The adaptation measures may include changes in practices and technologies, diversification of livelihood systems, accessing financial resources such as micro-insurance and micro-credit, migration, reconfiguring labor or resource allocation and collective action to access services, resources or markets<sup>[2]</sup>.

Developing countries, Arid and Semi-arid Lands (ASALS), and the poor in society are the most vulnerable and likely to be affected by climate change due to their low adaptive capacity. The risks threaten approximately 70% of rural people living in extreme poverty around the world<sup>[3]</sup>, as well as the agricultural systems and food production in the entire sub-Saharan Africa which primarily relies on rain-fed production that is climate sensitive. In Kenya, the ASALS occupy 89% of the country and are home to about 14 million people and approximately 70% of the national livestock herd estimated at 60 million and kept under extensive production<sup>[4,5]</sup> and prone to drought and other natural disasters.

The livestock sub-sector is the major enterprise in the ASALS and contributes 40% of the agricultural Gross Domestic Product (GDP) and 10% of Kenya's total GDP<sup>[6-8]</sup>. The vulnerability of pastoralists in ASALS is escalating due to recurrent natural disasters coupled with the increasing population growth and declining carrying capacity of the land. In the ASALS, the livestock sub-sector employs 90% of the residents and contributes 95% of the family income<sup>[7,9]</sup>. Therefore the government under vision 2030<sup>[10]</sup> recognizes the potential of arid lands and the livestock sub-sector as important drivers for economic growth.

The ecosystems in ASALS are most vulnerable due to climate change thus compounding development challenges of enhancing the resilience of communities whose livelihoods depend entirely on climate-sensitive resources<sup>[7,11]</sup>. Integrated land and water management in dry areas can contribute significantly to the recovery of agricultural production systems as well as reducing community vulnerabilities. This calls for proper land use planning<sup>[12]</sup>.

Concern for environmental planning in Kenya dates back to 1974 when conflicts resulting from competing land use interests led to the adoption of the National Environment Action Plan (NEAP)<sup>[13]</sup>. This was followed by the 1979-1983 and 1994-1996 development plans all of which emphasized the integration of environmental concerns into national development. Principles of sustainable development are further enshrined in chapter five part 1 section 60(1) of the constitution which states that land in Kenya shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable<sup>[14]</sup>. This shall include sound conservation and protection of ecologically sensitive areas like deltas as well as ensuring equitable sharing of the accruing benefits.

The Sessional paper No.1 of 2017 on National land policy emphasize on key environmental management principles and highlights a number of environmental problems affecting Kenya including degradation of natural resources such as forests, wildlife, water, marine and coastal resources<sup>[15]</sup>. Section 3.12 of the sessional paper recognizes diverse ecosystems in Kenya which include forests, wetlands, marine and coastal ecosystems, national parks, arid and semi-arid lands, watersheds, lakes and river basins and emphasize on judicious management of natural resources including land.

Rivers provide wet zones in the ASALS that act as settlement havens and areas for increased agricultural production. In Kenya athi and tana rivers act as a source of livelihoods to the communities within the Tana River Basin's spatial extent of approximately 132,000 km<sup>2</sup> which is equivalent to about 23% of the total area of the republic of Kenya<sup>[16]</sup> and contributes 32% of the total river runoff in Kenya<sup>[16]</sup>. It is also the longest river and the only one with a delta, Tana River delta (TRD), in Kenya. The delta lies within the tana delta sub-county which is an ASAL as well as an important wetland consisting of a mosaic of floodplains and forests of high biodiversity<sup>[17,18]</sup>.

The Tana Delta is arguably Kenya's largest, most ecologically and biologically diverse and socioeconomically important wetland in Kenya [18,19]. It covers an estimated area of 130,000 Ha and is immensely valuable to the local people who have built an intricate relationship between their lifestyles and the dynamics of the delta's ecosystems [19]. Further, tana river delta is of global, regional and national importance in the conservation of biodiversity resources [20]. It is home to rare, vulnerable, migratory and threatened species. Some of the unique bird species found in the area are malindi pipit, basra reed-warbler and tana river cisticola. Other important biodiversity resources found in the Delta are: hippopotamus, crocodiles, mangrove forests, fisheries and fisheries spawning grounds. Given the ecological importance of the area, it has been designated as an important bird area to help consolidate conservation of the area [20]. The key economic activities practised by the local communities include small-scale farming, fishing and livestock-keeping all of which rely on the occurrence of floods during long and short rain seasons. In tana river delta, pastoralism and farming are the most commonly practiced livelihood activities [21,22]. These activities have however been negatively affected by climatic changes mainly frequent droughts [23].

Sustainable utilization of the delta resources need development projects that enhance the livelihoods of local communities and promote sound conservation practices coordinated through a land use plan [19,24]. It was evident that land use planning has the potential to guide efficient and sustainable management and utilization of natural resources occurring in the delta by the local communities and other stakeholders. The vastness (16,012 km<sup>2</sup>) and economic potential of the tana delta has attracted private investors, including small ranches and large scale agricultural-based enterprises which have begun setting up operations in the area even before a comprehensive land use plan is developed [24]. This is changing the communities transhumance mode of resource utilization to sedentary as evidenced by village towns and school and hospital facilities coming up spurred by devolution as witnessed by increased road network and upcoming shopping centres as was observed by Mireri [20]. This presents threats to the existing natural resources like forests and their biological diversity.

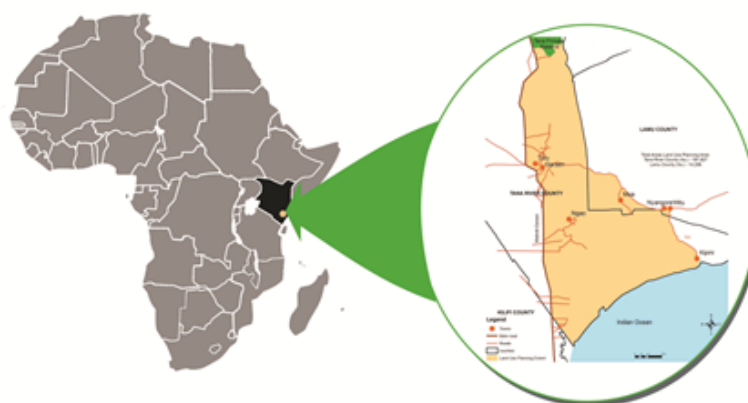
The trans boundary nature of delta resource use and access presents a formidable management challenge because of factors such as conflicting uses [25] and varied governance frameworks which lead to unsustainable exploitation of the resources as noted in Sessional paper No.1 of 2017 on national land policy. Other Acts relating to sustainable management of environmental resources and important ecosystems such as the Tana river delta include the forest conservation and management act [26], wildlife conservation and management act, the water act [27] and environmental management and coordination act [28], Tana and Athi river development authority that was formed by an act of parliament cap. 443 [29] and community land act, [30].

The declaration of TD as Kenya's 6<sup>th</sup> ramsar site on 12<sup>th</sup>, October 2012 [18] presented an opportunity that obligates, the state, local and global citizens to ensure the delta is conserved and sustainably managed for biodiversity conservation and improved community livelihoods. This action marked a turning point in the conservation of the delta amid controversy over plans to undertake jatropha farming [31,32], large scale sugarcane farming [17,33], and oil exploration [19]. This paper presents results from a study undertaken to determine the community livelihood sources in Tana delta, community perception on management of delta resources and the development of a land use plan for the Tana delta [24] and the effects of community use of delta natural resources on their conservation and provides recommendations on how the resources could be sustainably managed.

## **MATERIALS AND METHODS**

### **The Study Area**

The study was undertaken in the Tana delta which lies within the Tana Delta Sub County (TDSC) that is part of the Tana River County (TRC) (**Figure 1**). The County is one of the six counties in the coast region of Kenya. It borders kitui county to the west, garissa county to the north-east, isiolo county to the north, lamu county to the south-east, and kilifi county to the south [12]. The county has a total area of 38,862.2 Km<sup>2</sup> with a projected population of 349,338 [34], 76.9% of whom live in absolute poverty [12]. The TDSC headquarters is situated in minjilla and the delta is a common use area for communities inhabiting the area and seasonal immigrants. The delta is named after the Tana River (TR), the largest river in Kenya that stretches over a total length of 1,000 km [17,18,35]. The river originates from Mt. Kenya and aberdare ranges in central Kenya and has a catchment area of about 95,000 Km<sup>2</sup>, which is approximately 17% of Kenya's landmass [23]. The delta ranges between 2Km and up to 42Km in width.



**Figure 1.** Map of tana delta showing the study sites.

According to Kenya census report of 2009, tana delta district (sub county) has human population of 96,664 with the two major tribes being the Orma (and its sub-tribe, the wardhei) and the pokomo<sup>[21,35,36]</sup>. While the pokomo are small-scale farmers who live along tana river, the orma are pastoralists. The smaller indigenous tribes include the marakote, giriama, bajuni and the Arabs while the non-indigenous tribes include the kamba, kikuyu, meru and the luo, majority of who have diversified livelihoods sources that include cultivation along the river, bee keeping, fishing and trade.

**Data Collection Methods**

Secondary data and information was collected from previous related studies, government departmental reports, community Based organizations (CBOs) and Non-Government Organizations ' (NGOs) reports. Primary data was collected through participatory rural appraisal tools comprising of community meetings, social mapping, and Focus Group Discussion (FGD). Community meetings were held to undertake social mapping which included; village resource mapping, mobility analysis, stakeholder analysis, household listing and household well-being ranking. This enabled the communities visualize, appreciate and arouse their interest and activate their energies and resources in order to participate in bringing the appropriate change in their area. The meetings were also held with village leaders to select individuals to participate in FGD and Key Informant (KI) discussion. The meetings ensured that all wellbeing ranks were represented and all stakeholders were included in the data collection process.

Focus group discussion selection was guided by well-being ranking and gender representation guided by village elders and project staff. The latter was done guided by ethnic group representation ensuring that those communities which do not allow youth especially female held meetings separately and their deliberations shared through plenary captured their perceptions. Wellbeing ranking was done in each of the villages while nine FGD were held in order to obtain information from the community and officials of the nature based enterprise groups.

Key informant participants were selected from the village meetings while government officers were consulted based on their duties and experience to provide information about issues on the delta resources and the communities. Semi-structured household questionnaires were administered to sampled households in the nine sample villages. Five hundred and twenty five (525) representative households from nine villages representing distinct ethnic, socio-economic and ecological features of communities residing in the Tana delta were sampled (**Table 1**). The questionnaire was structured along the Livelihood Framework Analysis (LFA) which is effective in planning, implementation, monitoring and evaluation of development projects.

**Table 1.** Study site communities and their major livelihood activities.

Village	Major ethnic group	Major socio-economic activity
Walkon	Wardhei	Pastoralism
Onkolde	Orma	Pastoralism
Hewani	Pokomo	Farming
Wema	Pokomo	Farming
Shirikisho	Pokomo	Farming

Kipini	Giriama, Swahili and Pokomo	Farming and bee keeping
Hurara	Giriama and Kamba	Farming and bee keeping
Moa	Orma, Luo, Giriama and Luhya	Fishing and farming

Households participating in the various nature based enterprises were purposively selected for the interviews. Respective respondents aged 18 years and above, were interviewed using semi-structured questionnaires. Issues covered by the questionnaire included the wellbeing levels of selected households, level of community participation in land use planning [24,35] and who should be involved in delta management, livelihood sources and their monetary contribution to household income, community experiences with the livelihood sources and proposed future income generating activities. About 69% of respondents were male while 31% were female.

**Data Analysis**

Data analyses were conducted by use of SPSS version 17.0 and excel computer software programs. All the data collected were summarized and subjected to descriptive statistics involving computation of sums, means, and percentages. Summaries of representative practices were produced and the results presented using graphical and tabular techniques.

**RESULTS AND DISCUSSION**

**Poverty and Development**

Results of the study revealed that the majority of communities in the Tana Delta are poor. According to the study, approximately 75% of the population live below the current poverty line of at least USD 1.90 per day<sup>[37]</sup>. This is slightly higher than the number in 2005 where 72% were living below the poverty line. This is an indication that the population is getting poorer. The survey used a community Well-Being Rank (WBR) assigned to each household. This was developed by the community through village Participatory Rural Appraisal (PRA) meetings (Table 2). Through representative FGD the community categorized the households into four Well Being (WB) categories. A fifth worse-off rank which owns nothing and relies on others for survival was revealed by the community during feedback.

**Table 2.** Community perceived wellbeing ranking indicators of households in tana delta.

Rank A (perceived to be well off (very rich)	Rank B (perceived to be moderately well off or rich)	Rank C (perceived to be poor)	Rank D (perceived to be very poor)
Permanent house	Iron roofed and mud walled house	Grass thatched and mud walled house	Most have no housing and are accommodated by neighbours
Household income level of at least Kshs. 300,000 p.a	Household income level of between Kshs. 100,000-200,000 p.a	Household income level of between Kshs. 15,000-100,000 p.a	Household income level of approximately Kshs 15, 000 p. a
Household head on Permanent employment	Household head on contract employment	Casual employment main source of household income	Purely casual employees as they lack alternative sources of income
Ownership of 800 and more livestock among pastoral communities	Ownership of between 400-800 livestock among the pastoral communities	Ownership of between 100-400 livestock among pastoral communities	Ownership of none or a few goats or sheep among pastoral communities
Ownership of vehicle/s	Ownership of at least a motor bike	Ownership of a bicycle	Ownership of a bicycle
Ability to educate children up to college level	Ability to educate one’s children up to secondary school level	Ability to educate children up to primary school level	Inability to educate children up to primary level
Use of at least 10 acres of land for farming in the farming villages	Use of at least 5 acres of land for farming in the farming villages	Use of at least 1-2 acres of land for farming in the farming villages	Lack of (No ownership) land for farming in the farming villages
Ownership of 5 or more boats among the fishing villages of Moa	Ownership of between 1-4 boats among the fishing villages	Non-ownership of fishing boats among the fishing villages	Lack of (No ownership) fishing boats among the fishing villages

The distribution of household wellbeing ranks was varied in the study villages as outlined in Figure 2. Ozi village seems to have the highest number of poor households in WB category D which can be associated with lack of infrastructure especially reliable roads to transport fish and farm produce to the market. Moreover, since people live in clusters there is a possibility

that the enumerators could not get diversified responses from the respondents hence they might have up ended up with similar responses.

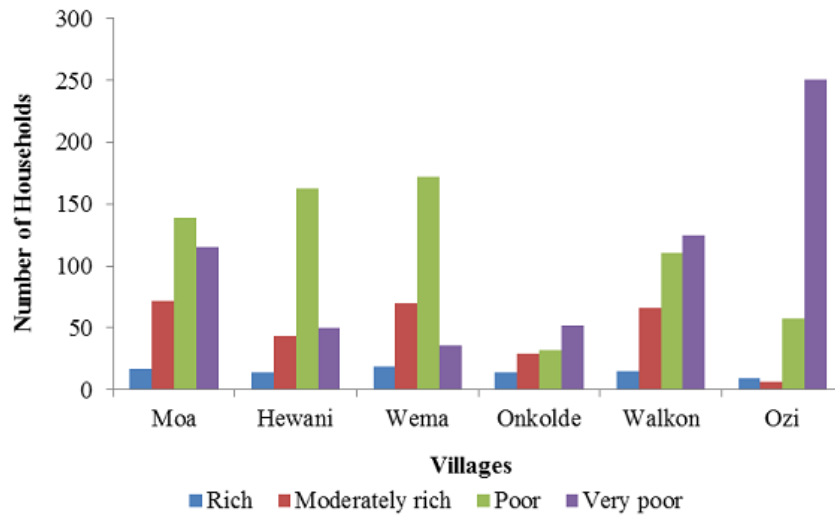


Figure 2. The wellbeing distribution among six study villages.

The high poverty level in tana delta was attributed to inadequate infrastructure development hence minimal investment and low education levels as shown in Table 3. The high poverty levels pose a challenge to the delta biodiversity which serves as a livelihood source for delta. This situation is being exacerbated by non-resident communities with some coming from neighboring districts, counties and countries.

Table 3. School attendance in tana delta district.

Level of schooling	Percentage (%)
At school	35.7
Left school	23.4
Never attended school	39.3
Not stated	1.6

The study revealed that there are high illiteracy levels in the delta with only 11% of the respondents having attained primary school education. The results are consistent with those of GoK<sup>[38]</sup> which also established that majority of residents have either dropped out of school or have never attended school with only a small percentage attending school. Cultural factors such as nomadic lifestyles and early marriages of girls, especially in pastoral communities were attributed to low school enrollment levels. Furthermore, there are inadequate learning facilities in the area and few role models.

Focus group discussion and KI attributed poverty to low education levels; hence, there is need for the government, private sector and other stakeholders to put in place educational facilities as the number of schools and teachers in the sub-county is insufficient. Furthermore, there should be awareness creation to local communities on the importance of education as an investment venture. Focus group discussion agreed that punitive measures should be taken against parents who fail to enroll their children in school. These measures could help improve education standards in the area thus giving resident communities a high bargaining power in the job market. Further this could be improved through initiating income generating activities in the tana delta. Nature based enterprises could have a direct contribution to the Delta residents. However, their quantity and quality need to be enhanced in order to further improve the livelihoods of the resident communities and reduce the acute inequalities in terms of resource access and use, as well as power and influence. This shall play an important role in managing resource use conflicts. Further strategic and deliberate affirmative actions may be necessary to assist the disadvantaged groups benefit from the delta resources.

The study further revealed that over 80% of the delta population lives in rural areas with Garsen being the major urban area. Access to basic social amenities such as schools, hospitals and clean water is very limited with majority of the residents having to walk for several kilometers to access these amenities. Moreover the road network is very poor while electricity supply is limited to urban areas. Majority of the houses are temporary while the rest are either semi-permanent or



permanent. The semi-permanent houses are mainly found among the agriculturalists who build their houses with mud walls and corrugated iron roofs. The pastoralists however live in structures with thatched roofs and walls reinforced with poles.

**Contribution of Income Generating Activities to Community Livelihoods**

Livestock production and farming were the main sources of livelihood in Tana delta in this study (Figure 3) as had been noted by Odhengo et al. [35]. Surprisingly the income from livestock does not equally trickle to the households in the Delta. Key informant and FGD attributed this scenario to the fact that a large portion of the livestock in the delta was owned by people residing outside the Tana delta as was also noted by Smalley, and Corbera [39]. The livestock sales the funds that flow back to the delta from the delta residents who own livestock, the salary paid to the workers engaged in the grazing of livestock in the delta and sale of milk by the herders as they are allowed to keep the milk sale proceeds by the livestock owners. The non-delta residents get the money after selling their livestock and use it elsewhere.

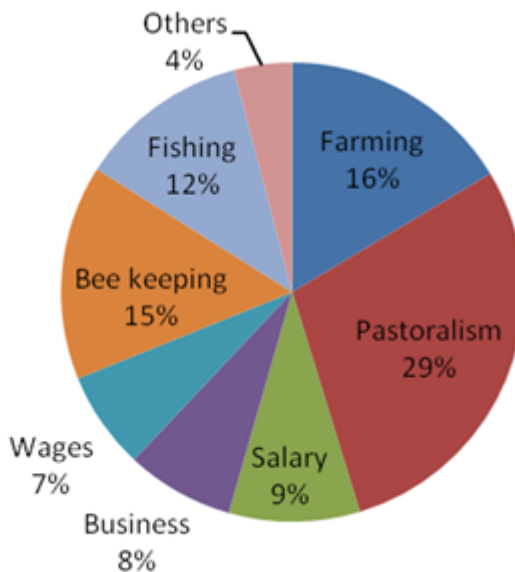


Figure 3. Percentage contribution of various livelihood sources to household income.

Therefore, even though livestock production is undertaken on a larger scale in Tana Delta as compared to farming, the contribution of farming to household income was greater than that of livestock production (Figure 4). On the contrary, farming contributed directly to household incomes. On average farming contributed Ksh.64, 116 to household incomes per annum while livestock production contributed Ksh 46,055. Salary contributed the least to household income (Table 4).

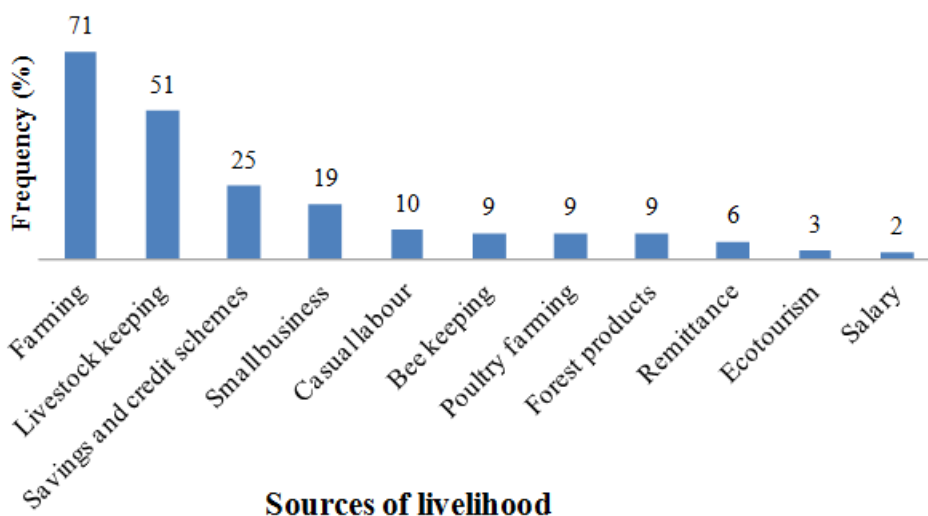


Figure 4. Percentage contribution of various livelihood sources to household income in the delta.

**Table 4.** Mean annual household income from various livelihood activities.

Village	Mean income (Kshs)							
	Farming	Pastoralism	Salary	Business	Wages	Bee keeping	Fishing	Others
Onkolde	22,200	135,000	2,333	63,000	444	5,405	135	0
Wema	9,214	3,800	22,079	2,630	7,643	0	0	4,760
Hewani	9,995	63,357	20,404	4,000	50,612	1,256	24,250	0
Moa	38,710	69,100	5,000	5,433	11,050	0	0	18,090
Walkon	4,433	62,093	0	883	0	0	0	0
Ozi	14,828	9,400	5,667	7,500	2,683	267	3,677	1,067
Hurara	28,700	8,430	19,100	3,980	8,234	72,000	0	20,000
Shirikisho	30,647	3,400	17,477	5,400	4,875	81,005	0	10,050
Kipini	42,535	30,600	30,070	7,920	6,063	83,745	0	0
Mean income per source	64,116	46,055	13,570	11,194	10,178	22,408	17,706	5,996

***Livestock production***

Livestock keeping through pastoralism is the main livelihood production system in Tana delta. The orma and wardei are the main livestock keepers in the area [17]. The main livestock types kept are cattle, sheep and goats with cattle forming the bulk of all livestock. Donkeys are kept by the pastoralists as beasts of burden. The camel population is very small. Pastoralism is a major economic activity in the delta where local communities keep large herds of livestock as a sign of wealth and prestige. The orma and Wardei communities practice pastoralism which entails care of large herds of animals based on transhumance and whereby mobility is used as an adaptation strategy in search for water and grass and to avoid the presence of raiders.

Livestock movement in the delta is due to two main reasons. Firstly, the movement occurs due to the grazing patterns of the pastoralist and secondly due to trade in the livestock. During wet seasons in the delta, herders move West to as far as kitui and mwingi about 313 km. Key Informant indicated that they also graze in Somalia but as the rainy season ends they return to the delta as was noted by Mireri [20]. The driest months are between January and March when herds converge in the heart of the delta, passing through group ranches and crop farms causing conflicts as they move as was also noted by FAO [12]. Keeping large herds has however posed environmental and social challenges. For instance, although the migration of livestock in and out of the delta explains the importance of Tana river delta to pastoralists, it has often been a major source of conflicts between the orma and pokomo communities as migrating livestock graze on crops belonging to the Pokomo.

Results of the study indicate that there are at least 900,000 herds of cattle and over 1 million heads of goats and sheep. Majority of the pastoralists were reluctant to give the exact number of their livestock and indicated that counting the livestock would bring bad luck to them. The number of cattle reported by the study is therefore an under-estimate but give a rough estimate of livestock ownership in the delta and also noting different figures given by earlier studies as noted by Duvail et al. [36]. The economic returns from livestock farming is high considering that a mature cow and goat/sheep being sold at market price of Ksh 50,000 and Ksh 5,000 respectively, it would be expected that pastoralism would contribute significantly to household incomes.

The study revealed that the average annual contribution of pastoralism to household income is Ksh 46,055. This contribution was considered very low and was mainly attributed to the fact that most livestock were owned by outsiders, majority of those with the livestock are employed herders, who either live in temporary shelters in transit kraals or are housed by friends or tribesmen living in the delta. They only herd the animals to the market for the owners (decision makers) or the appointed agents to sell leaving them with scanty details of the true cash value of the livestock. The money earned from livestock sale is banked and hardly trickles as contribution to the local economy. The use of the delta resources to create wealth through pastoralism does not therefore trickle down directly to the locals with the herders benefiting mainly from milk production



and an annual compensation of one mature cow. Further, this lucrative economic activity hardly contributes to the development of the delta.

Indigenous poultry are kept mainly for sale by the pokomos who live mainly along the riverine and pastoral community women. Notably, commercial poultry keeping is also picking up slowly.

***Crop farming***

Small scale farming is the most important livelihood source which also contributes the highest amount of income to households in the delta, with the average size of land a household has access to being 1.5 hectares. The results are comparable to Hanshi, [25] which found farming to be the main source of household income. Perennial crops such as mangoes and bananas are mainly grown along the river bank while rice and grains are grown in the flood plains. The study indicates that farming is undertaken in all the sampled villages mainly for subsistence with the surplus produce being sold in the local market. The average annual household income from farming was estimated at Ksh 64,116. This income was considered low from the perspective of Tana Delta’s huge potential for farming [40]. Residents said that agricultural production was low due to lack of inputs such as quality seeds and fertilizers, frequent droughts and inadequate access to land and free grazing of livestock by pastoralists (Table 5).

**Table 5.**Challenges affecting livelihood activities in tana delta.

Livelihood activity	Challenges	Suggested means of addressing challenges
Crop farming	Inadequate rainfall/Perennial droughts	Adoption of sustainable irrigation techniques
	Inadequate arable land	Improvement of road network
	Low market prices	Provision of certified seeds and fertilizers to farmers at subsidized rate
	Crop pests and diseases	
	Poor road network limiting access to markets Inadequate access to certified seeds and fertilizers	
	Crop invasion by wild animals	
Livestock keeping	Inadequate rainfall/Perennial droughts	Community sensitization on appropriate livestock stocking levels
	Pests and diseases	Training on pests and disease management
	Low market prices	Construction of cattle dips
	Resource use conflicts	Conflict resolution
Savings and credit schemes	Inadequate awareness/illiteracy	Community training and sensitization
Small businesses	Poor road network resulting to high commodity prices	Improved road network
	High cost of living resulting to low purchasing power	Training of motorcycle operators
	High cases of motorcycle accidents	
Casual labour	Inadequate job opportunities	Establishment of cottage industries
Bee keeping	Drought	Enhanced training on bee keeping
	Invasion by predators e.g honey badger	Provision of honey harvesting equipment
	Theft of hives	Construction of apiaries
	Inadequate skills on bee keeping	

Poultry farming	Pests and diseases	Provision of vaccination services and community training on pest and disease management
Forest products	Poor charcoal production techniques resulting to high rates of deforestation	Training on sustainable charcoal production techniques
		Availability of alternative income generating activities
Ecotourism	Insecurity	Putting in place security measures
	Inadequate skills in ecotourism development	Incentives to attract tourists

Farming communities need to be capacity built so that they can embrace high value commercial crops such as horticultural crops in order to increase their incomes and adopt modern farming technologies. This should be further enhanced by value addition and ensuring market links. River Tana should also be harnessed for irrigation in order to increase production especially during dry periods. This should be further enhanced by value addition and ensuring market links. The Tana delta has a huge farming potential. Farming is however still limited to small scale cultivation along the river banks and in the flood plains. The ongoing land use planning should clearly aim at addressing these challenges while farming communities need to be capacity built so that they can embrace high value commercial crops such as horticultural crops so as to increase their incomes. River tana should also be harnessed for irrigation in order to increase production especially during drought.

### ***Beekeeping***

The study revealed that beekeeping is carried out as an economic activity in Walkon, Hewani, Kipini, Shirikisho and Hurara villages. It is an important economic activity in the tana delta with most of it occurring along the riverine area where nectar is abundant. Honey in the delta is produced by two main producers of honey comprising of individual farmers and registered community groups. Individual farmers tend to use traditional log hives made from logs taken from local trees and in which harvesting is done only once a year with major disruption to the hive's structure and colony. Registered groups on the other hand tend to use modern manufactured top bar and langstroth hives in which harvesting can be done twice a year with little disruption to the hive or colony, and these hives are often given by donors such as Nature Kenya, world vision and arid lands resource management project, and often to groups. The study targeted groups that were supported by nature Kenya through funding from Department for International Development (DFID) which consisted of between 10-25 members. Beekeeping is good income source as it was reported that under good management, 20 kilograms of honey can be harvested from a Kenya top bar hive and 25 kilograms of honey from a langstroth (delta strategic environmental assessment baseline report <sup>[41]</sup>). The price of honey in 2013 in the local market stood at Ksh 300 per kilogram. With the current 20 Kenya top bar hives per group in each of the villages, and with two harvests per year each producing an average of 20 kilograms at a price of Ksh 300 per kilogram, the total income generated from honey per harvest would be Ksh 240,000 per group in each village.

Honey production in the delta was however found to be very low with the average annual income per group being Ksh 70,000, and the average annual contribution to household income being Ksh22,408. The low honey production and consequently low income derived from beekeeping was attributed to the fact that the farmers are still learning and face challenges due to poor management, low market prices and frequent droughts resulting to high bee absconding rates (**Table 5**). KI and FGD indicated that more training, capacity building and sensitization need to be carried out with a view of improving community skills in managing the beekeeping enterprises. The program also needs to help community members to find better and more profitable markets for their produce to enhance the gains made. Further there is need for value addition through building a bulking, processing and marketing centre coupled with branding the honey 'tana delta natural honey'.

### ***Fishing***

Focus group discussion revealed that fishing is mainly practiced in Moa, Ozi, Hewani and Onkolde villages with Moa being the leading. It is done in the delta's lakes and water courses with the main fishing communities being the Malakote, Bajuni and Luo. Fish farming has however been introduced to communities in the Tana River Delta mainly by donor projects such as the Nature Kenya-DFID program with an aim of diversifying income sources and improving community benefits from fishing enterprises. The fish farming enterprises are however still in their formative stages and therefore their economic contribution to community livelihoods could not be established yet.

Key Informant Interview and FGD indicated that there is presence of several riverine fish species most of which are found in the main river channels particularly in sheltered, low velocity areas, swamps and in oxbow lakes. Lake Moa had the

highest number of fish and this explains why Moa village was leading in fishing. The lake has 300 fishers and 30 boats with a total of 40 registered traders and reported 20 other illegal fishermen. Most of the fish is sold smoked, fried or sun dried. Fish from lake moa serves both local as well as markets in distant towns such as garsen, hola, malindi, gongoni and mombasa.

Fish is the second most important animal protein in Tana delta after livestock. Traditionally fish was not consumed by pastoral communities. Information obtained from focus group discussion indicate that the situation has changed and some pastoralists now eat fish besides obtaining income through fishing activities. This was attributed to the immigration of the Luo community who originates from the shores of Lake Victoria and is traditionally fish mongers into the Tana Delta which influenced the other communities and further enhanced the exploitation of fisheries for food, employment and income as was noted by Matiku<sup>[42]</sup>. The average annual household income from fishing was found to be Ksh 17,706. Inadequate funds to improve fishing enterprises, poor storage facilities and declining fish stocks were attributed to low yields and consequently low household income (**Table 4**).

Therefore, more training, capacity building and sensitization need to be carried out with a view of improving community skills in managing the enterprises. Credit facilities should also be availed to enable community members expand these enterprises while initiatives to help community members access better and more profitable markets for their produce should be initiated.

### ***Employment***

Salaried employment was low across all the sampled villages. This scenario was largely attributed to the low education levels that hinder residents from accessing high end gainful permanent employment. Casual employment was more common in the farming communities of Wema and Hewani as opposed to pastoralist communities where it was very low. Majority of those in casual employment work in Tana and Athi river development authority rice farms. Although the number of people involved in casual employment was relatively low, it contributes a considerable amount of income to the households with employed members.

The nature based enterprises have a direct contribution to the delta residents (**Table 4**). However, their quantity and quality need to be enhanced in order to further improve the livelihoods of the resident communities and reduce the acute inequalities in terms of resource access and use, as well as power and influence. This shall play an important role in managing resource use conflicts. Further strategic and deliberate affirmative actions may be necessary to assist the disadvantaged groups benefit from the delta resources.

Therefore, more training, capacity building and sensitization need to be carried out with a view of improving community skills in managing the enterprises. Credit facilities should also be availed to enable community members expand these enterprises while initiatives to help community members access better and more profitable markets for their produce should be made. **Table 5** highlights some of the challenges affecting livelihood activities in Tana Delta and the suggested means of addressing them as perceived by TD community during FGD.

### **Land Tenure, Use, Access and Community Participation In Land Use Planning**

Farmer's lack of secure land ownership had prevented them from investing in land development and limited their access to land with the pastoralists accessing nearly all the land and occasionally interfering with their farms and/or even fueling conflicts<sup>[22,25]</sup>. Land tenure is based on communal land ownership<sup>[12]</sup>, and land access rights are mainly acquired through inheritance<sup>[12]</sup> but purchase and allocation by chiefs is common. The government realized the importance of land in livelihood improvement in Sessional paper no 1 of 2017 by indicating that "Land is needed to provide basic social services and to support economic activities in all sectors. While there has been significant progress over the past four decades, land ownership and use patterns still contribute to poverty and inequality, as there are inadequate opportunities for poor people to access<sup>[15]</sup>".

The ongoing land use planning should clearly aim at addressing these challenges as land ownership remains an emotive issue and as such, the survey focussed on land use and access realizing that this study showed that more men participate in land use planning (**Figure 5**). It was evident that the community members are aware that the delta is a trust land<sup>[30]</sup> under which although they are the "owners", other people have access to. They are also aware that their access rights are not secure and are hinging their hope on the new constitution and non-governmental organizations such as Nature Kenya who have been assisting them to advocate for their rights and develop a land use plan<sup>[19]</sup>. Some villages, mainly those of pastoralists use the delta resources for grazing more than others, and the use often goes beyond the delta area and extends to other areas such as Marereni in Malindi and Mpeketoni in Lamu with instances where it goes to as far as Somalia.

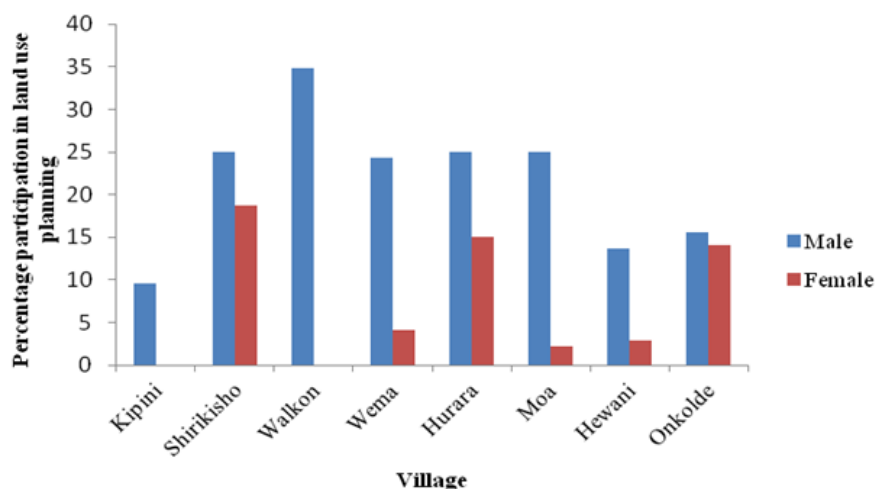


Figure 5. Level of participation in land use planning by village and gender.

Land transfers for large scale development and lack of a land use master plan for the Tana Delta was leading to social, cultural, environmental and economic impacts. These impacts include involuntary displacement of people, increase in landlessness, restricted access to grazing land and water, and as a result, increase in conflicts within communities, between different ethnic groups, and more recently between communities and external investors [43]. This implies that for the delta to be sustainably managed these communities have to be assured of access to land resources for their livelihood activities beyond the delta. Delta resource use planning system should recognize this scenario for it to support sustainable resource management. Awareness and publicity should be multi-faceted and target local, national and global citizens.

In the delta as awareness creation focuses on the residents it should also target those outside the delta to facilitate the pastoralists reduce their stock to levels that the Delta could support and continue accessing the non-delta grazing zones especially during the rain season. This could be called a grazing space planning approach, a multi-stakeholder approach that brings on board pastoralists, farmers, politicians, NGOs and the national government officers from the affected counties. Additionally it should include peace building initiatives which incorporate community based solutions to conflict management. The study further revealed that the average number of people aware of land use planning is 35.26% male and 13.17% female, while the percentage average of those that have participated in land use planning stand at 21.61% and 7.17% males and females respectively. The need for land use plan has been emphasized by the government in sessional paper no 1 [15].

Kipini village had the least number of households both aware of and participating in land use planning processes while Hurara had all the households aware of on-going land use planning. The scenario in Kipini could perhaps be attributed to its distant location from the wider Tana Delta region and specifically Garsen town and Minjilla trading centre, the main administrative centres, as well as the fact that the engagement of Kipini village in land use planning activities began at later stages as compared to the rest of the villages.

Table 6. Awareness of land use planning by village and gender in 2013.

Village	Male awareness (%)	Female awareness (%)	Overall awareness (%)
Hewani	56.12	10.07	66.19
Wema	22.22	5.56	27.78
Onkolde	31.35	14.06	45.31
Walkon	22.93	0	22.93
Hurara	70.0	30.0	100.0
Shirikisho	35.29	41.18	76.47
Kipini	5.56	0	5.56
Moa	38.64	4.55	43.18

Kipao	-	-	-
Ozi	-	-	-
Average awareness	35.25	13.18	48.43

In both Kipini and Walkon villages, no females were either aware of or had participated in land use planning. The situation in Walkon could be attributed to cultural factors that confine women to domestic activities in the mainly pastoralist community. In Wema, Moa and Hewani, the level of female awareness and participation in land use planning was also low compared to that of their male counter parts. Shirikisho, Hurara and Onkolde had the highest percentage of female awareness and participation in land use planning with Shirikisho leading. This conforms to FAO [12] that many pastoral communities are patriarchal and men own livestock and land resources.

Generally, the level of awareness among females was low as compared to their male counterparts, and cultural factors could be responsible for this situation considering that women spend a considerable amount of their time performing domestic chores and hardly have time for other engagements. This was contributed by socio-cultural and other factors like high illiteracy levels that limit women participation in decision making [12]. Though the findings indicate low community participation, the level of awareness among resident members in villages such as Shirikisho and Hurara who are mainly crop farmers is high as opposed to pastoralists who are mostly non-residents. This scenario is expected to improve the social status of resident communities and ensure better access and use of tana delta resources hence reducing acute group inequalities, thus contributing to conflict management. The low levels of community participation in land use planning could be attributed to inadequate community awareness on the ongoing land use planning processes as well as the nomadic nature of most residents since those that were initially involved in the process might have moved out of the Tana Delta. Furthermore, current land use planning initiatives engage employed herders and small scale livestock keepers, who have little power and authority on grazing and delta resource use and access and may not be the ones who bring back the livestock in the subsequent years. Effective land use planning therefore requires active engagement of livestock owners as well as more awareness creation and capacity building on the ongoing land use planning process. This could be further enhanced by training Tana delta resident peer awareness teams by targeting the resident members.

Effective land use planning require active engagement of livestock owners who are the main decision makers in terms of access and use of delta resources as opposed to the herders who are merely decision implementers. Furthermore, there is need for deliberate engagement of the resident community members and building their capacity to act as agents for peer awareness creation since the herders who graze the animals in the delta are not necessarily the same who bring back their livestock year in year out in search of pasture and water.

### **CONCLUSION**

Sustainable management of the Delta must ensure effective land use planning that ensures a balance between conservation, community access to land resources for their livelihood activities and private development. This will ensure peaceful co-existence among the various user groups hence contributing to economic stability of the delta. Furthermore, there is need to constitute a multi-stakeholder forum that brings on board pastoralists, farmers, politicians, NGOs and the national government to spearhead peace building initiatives in the area. Targeted efforts should also be made to bring on board decision makers at the community level. These stakeholders should have clear roles, standards and enforcement procedures aimed at preventing conflicts while local solutions to conflict management should form an integral part of the peace building initiatives. The government (both national and county) should provide oversight and schematic technical and policy support to ensure sustainable use and management of the Delta resources.

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