

Factors influencing natural resource management in pastoral systems: Case of Tana River County, Kenya



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Factors influencing natural resource management in pastoral systems: Case of Tana River County, Kenya

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Acronyms

ASAL	Arid and semi-arid lands
CFA	Community forest association
CLMB	County Land Management Board
FGD	Focus group discussion
IGO	Inter-governmental organization
KFS	Kenya Forest Service
KWS	Kenya Wildlife Service
MTAP	Medium-term ASAL program
NDMA	National Drought Management Authority
NEMA	National Environment Management Authority
NGO	Non-governmental organization
RPLRP	Regional Pastoral Livelihoods Resilience Project
TARDA	Tana and Athi River Development Authority
UNICEF	United Nations International Children's Emergency Fund
UNPFII	United Nations Permanent Forum on Indigenous Issues
WAMIP	World Alliance of Mobile Indigenous People
WISP	World Initiative for Sustainable Pastoralism
WMC	Water management committee
WRMA	Water Resource Management Authority
WRUA	Water resource user association

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Executive summary

Pastoralism, the practice of extensive livestock herding, is the major economic activity and livelihood for many of the communities living in arid and semi-arid lands (ASALs). Pastoralism serves not only as a food production system but also as a means of conserving rangeland biodiversity. Functioning pastoralist grazing systems can be a tool for the management of rangeland ecosystems, by enriching low-quality soils and preventing bush encroachment through the combination of feeding habits of grazers and browsers.

An ecosystem results from the interactions among the biological and physical components of the environment. Ecosystems are important not only in their own right but also the services they provide. There are limits, however, to the resilience of ecosystems and appropriate management strategies are required to preserve the integrity of the natural resources found within them and to ensure sustainable productivity. This is certainly the case in pastoral systems, which are not unaffected by the threats that face ecosystems around the world.

Tana River County as a semi-arid area suffers from water scarcity, amongst other threats to their livelihoods. Communities living in this county practise pastoralism, farming, hunting and fishing to support their livelihoods: They constantly rely on ecosystem services for their activities including water, land and forest resources.

In this study, we carried out an assessment of ecosystem services that are most valued within the county, options for natural resource and ecosystem management being implemented, stakeholder preferences and perceptions of the management options. This report presents findings from the study and further considers management options that were not being considered by the stakeholders, factors that are likely to influence the implementation of the suggested management options and finally, gendered perception of these issues.

From the findings it was evident that among the main categories of ecosystem services, provisioning services are the best understood and most valued by people in Tana River County. As such, there is a common interest among the community members in ensuring best practices are used when utilizing natural resources. It was also noted that stakeholders had differing opinions over which management options were more important than others. For instance, some interventions and approaches for ecosystem services protection and/or improvement were more preferred by women than by men. In other instances, some management options were better preferred by community members than by the county officials.

Conclusions and recommendations from this report will feed into local and watershed-level decisions aimed at minimizing the impact of various practices on the environment and enhancing the value of ecosystem services from rangelands to improve livelihoods and restore degraded lands.

Preface

'Enhancing the value of ecosystem services in pastoral systems' (EVESPS) is a project implemented by the International Livestock Research Institute (ILRI) under the umbrella of the CGIAR Research Program on Water, Land and Ecosystems (WLE) led by the International Water Management Institute (IWMI). The over-arching goal of the project is to improve land management planning at local, landscape and watershed scales. The project aims to identify grazing and rangeland management options that will strengthen livelihoods over the long term through increased use of information on ecosystem services and through engagement with stakeholders on the role played by ecosystem services in the livelihoods of pastoralists. Quantitative modeling of ecosystem services prioritized by stakeholders will be used in the analysis. The objective is to assist decision-makers from local to landscape and watershed scales to be better informed on how implementation of options for improved management and productivity of rangelands are likely to affect landscape-level delivery of priority ecosystem services. In addition, the project seeks to contribute a livestock and rangelands perspective to ecosystem services analysis, including refinement of existing models, to adequately capture ecosystem service flows within and from rangelands.

This report describes the findings of a study carried out for the EVESPS project. The study included an assessment of the ecosystem services that are most valued within Tana River County, Kenya, the options for management of natural resources and ecosystem services being implemented, stakeholder preferences and perceptions of management options. The report also considers factors that are likely to influence the implementation of the various management options, as well as gendered perceptions on these issues.

I Introduction

An ecosystem results from the interaction among biological and physical components of the environment. Ecosystems are important not only in their own right but also for the services they provide. Appropriate management strategies are required to preserve the integrity of the natural resources found within them and to ensure sustainable productivity. Proper management of rangeland ecosystems is especially important both for pastoral production (Jode 2014) and for the benefits provided by rangeland ecosystem services to people beyond pastoralist communities.

Pastoralism is valued as a food production system. It can also be understood as a system for managing ecosystem services—it is a means of conserving rangeland biodiversity. Rangeland soils are enriched through the fecal deposit of livestock contributing to better quality soils, and it can also help to control bush encroachment through the various feeding habits of different livestock. However, pastoral systems are not unaffected by the threats that ecosystems face around the world.

Pastoralism as a practice has faced threats in the past and continues to do so in the present. Such threats include land rights and issues around access to land; unfavourable policies that have not promoted and protected pastoralists and the challenge of being over-taken and displaced by other activities such as commercial farming, conservation areas, and mining; activities that are viewed as more commercially viable than extensive livestock production. For pastoral systems to continue to run effectively and with sustainable use of the natural resources, a combination of appropriate policies and investments, secure land tenure, and a range of appropriate management options have to be put in place.

In Kenya, conservation of the pastoral lands is not a new concept to the pastoralists or the communities living in the rangelands. They view the land as their source of livelihood and appreciate the need for protection strategies for secure livelihoods.

Interventions have arisen following the local, national and global recognition of pastoralism as a source of livelihood and as a serious production system like any other. This has provided an opportunity for pastoralists to participate in the decision-making processes on matters affecting the ASALs. Involving pastoralist communities has resulted in greater global respect between policymakers and the pastoralists and has also increased the credibility and visibility of pastoralism (McGahey, Davies, Hagelberg, and Ouedraogo 2014).

Conservation and wise use of an important ecosystem, as is the Tana Basin, is the drive for this study which seeks to work with all stakeholders in Tana River County. The objective is to establish management options that can be implemented and enforced to enhance the value of ecosystem services and thus preserve this fragile yet important ecosystem. Improved knowledge of pastoralism and continued global advocacy is the key towards raising the awareness of environmental governance which is the root of sustainable land management.

This study was carried out in Tana River County which was selected as a study site owing to its international importance as an area with birds, wildlife and livestock ('Birdlife-Tana Delta Kenya,' n. d.). Tana River County consists of communities of pastoralists, hunters and gatherers, farmers and fishermen. Pastoralists and hunters are primarily found in the hinterland while the farmers and fishermen live mostly along the Tana River.

This study identified the most valued ecosystem services in Tana River County, the management options that are currently being implemented, those under consideration, those not considered by the stakeholders and stakeholder perceptions and preference of these interventions. A gender-disaggregated view was also provided for all the study questions. The findings presented in this report are based on information provided by community members, county government officials and other stakeholders working in Tana River County. Community stakeholders included the communities living in the area, with a special focus on pastoralists but also including the farmers, fishermen and hunters who also depend on the ecosystem services in the county and who are responsible for sustainable management of the same.

The findings in this report will provide policymakers and county planners with insight on how current practices affect the environment and any other management options that they may not have been considered but may be useful in enhancing the values of the various ecosystem services. The management options enumerated and analysed in this report are aimed at strengthening the commitment towards maintaining and enhancing the value of ecosystem services in these pastoral systems.

2 Literature review

2.1 Pastoral practices, livelihoods and importance

Pastoralism is widely practised in drylands of the world, in Africa, Asia, America, Europe and Australia. Pastoralism is valuable as a food production system as it is seen as a sustainable way of producing food using resources found in natural landscapes ('Pastoral systems,' n. d.). Pastoralism is also seen as a means of conserving rangeland biodiversity, a tool for combatting desertification and as an adaptation and mitigation strategy to climate change effects.

Communities practising pastoralism previously had a positive interaction with their natural environment as evidenced by their use of extensive grazing, herd mobility and dry-and-wet-season grazing rotations ('FAO- Pastoralism in the new millennium,' n. d.). These strategies ensured proper use of their natural environment where the rotational short-term use of the pasture allowed for vegetation regeneration. Herd mobility and wet-and-dry-season grazing sites led to better land management and reduced land degradation.

Pastoralism is also seen as economical when comparison is done between the amounts of fertilizer and water required by agriculture and the fact that herding naturally enriches low quality soils through fecal deposits from the livestock ('FAO- Collection of information on Animal Production and Health,' n. d.). Pastoralism hinders bush encroachment due to the feeding habits of the mixed livestock, some are grazers and others are browsers. This consequently reduces the likelihood of bush fires. The trampling effect on the soil as herds move across the land also aids in soil mixing and soil formation.

However, the threats faced are many and great. For instance, formalization of land rights that leads to privatization of land often results in decreased available land for pastoralists which results in increased conflict, impoverishment and land degradation on the little land left available. Pastoralism also suffers the threat of exclusion from the list of important land use activities as other activities, such as commercial farming, national parks and other conservation initiatives and mining are viewed to be more economically viable than extensive livestock production. Another issue that pastoralists face is access to land and issues of land rights.

In view of this, various pastoralist organizations such as the World Initiative for Sustainable Pastoralism (WISP), World Alliance of Mobile Indigenous People (WAMIP) and the United Nations Permanent Forum on Indigenous Issues (UNPFII), have been striving to safeguard the interest of pastoralists around the world. In Kenya, there is the Kenya Pastoral Forum and the Pastoralist Indigenous NGO Forum that serves East Africa.

2.2 Ecosystems in pastoral systems

Pastoral systems are mostly found in arid and semi-arid regions. Communities living in pastoral areas depend on the goods and services provided by rangeland ecosystems but there are certain challenges they face that hamper their ability to protect ecosystem services while maintaining their livelihoods. These challenges include inadequate land

rights and access to land, unfavourable policies that do not promote and protect pastoralists, and the challenge of being overtaken and displaced by other land uses.

The mix of activities and practices in pastoral systems means that in order for pastoral systems to continue to run effectively without over use of the natural resources, several management options have to be put in place to maintain the ecosystem services. Pollution, flooding and reduction in open lands are some of the threats that ecosystems face. Other threats include settlement patterns, farm encroachment, bush-encroachment, human mobility patterns, inappropriate grazing patterns, land degradation, deforestation and urbanization.

3 Problem statement/research question

Ecosystems require appropriate management strategies to ensure their sustainability. This work seeks to investigate the role that activities in pastoral systems play in managing and improving the value of ecosystem services. In this project, the strategies and management options under implementation or those options under consideration will be assessed and analysed at a later stage in the form of various scenarios to determine the strengths and weaknesses of different management practices which can be used by the local lead institution, in our case, Kigaruni Water Resource Users Association (WRUA), in making better informed decisions.

Implementation of these management options will represent important strides made towards sustainable pastoral systems and resilient ecosystems. This document reports on one component of that work, where we carried out an assessment of the management options being implemented in Tana River County, issues related to delivery of these ecosystem services and a gender perspective to better explain the stakeholder perceptions and preferences of these ecosystem services and the management options being implemented and considered.

4 Study area

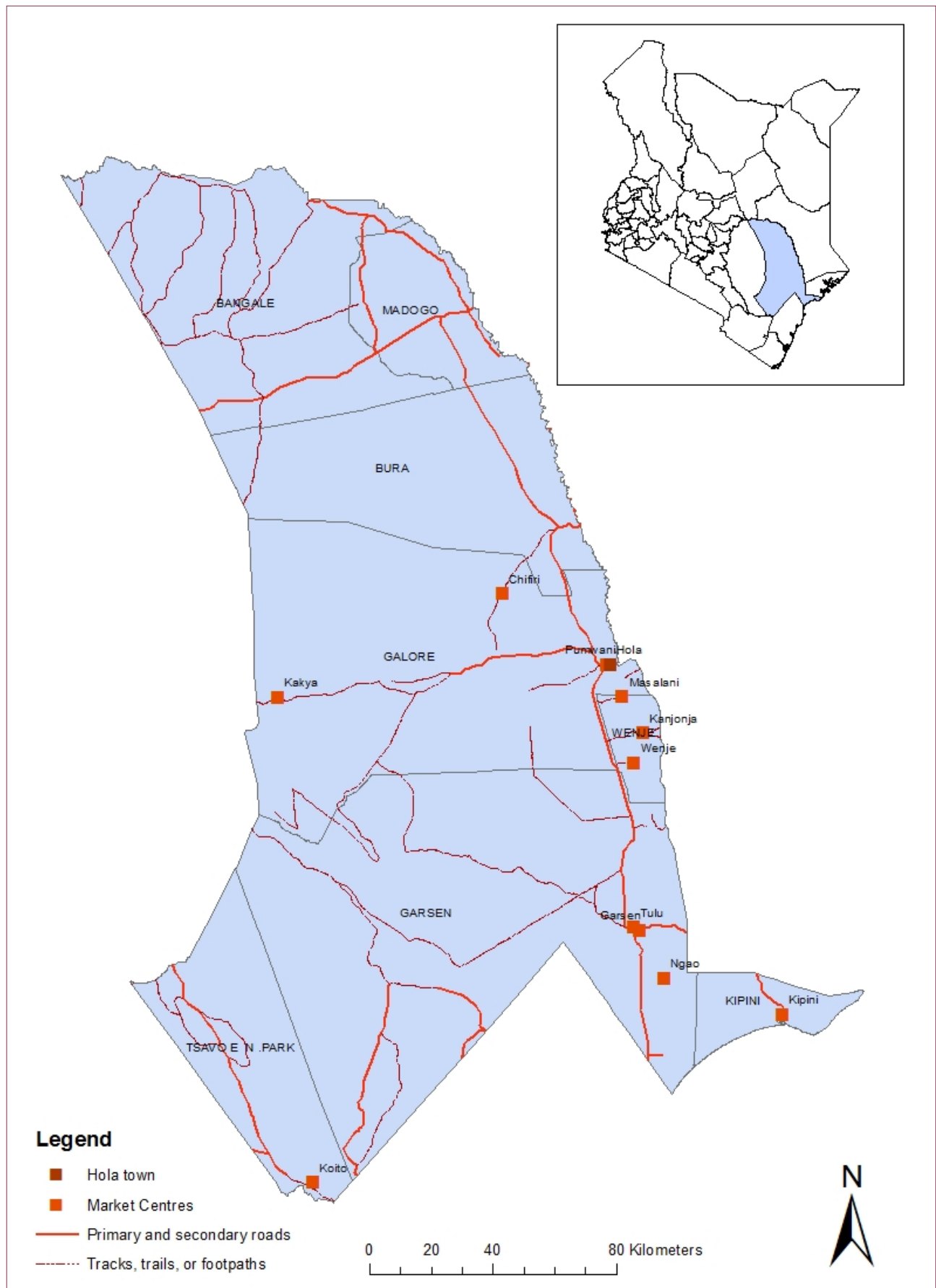
Tana River is a county found in the former Coast Province in Kenya lying at 1°30'S 40°0'E. The county is named after Kenya's longest river, Tana River, which flows from the north in Garissa to Kipini in the east, and Malindi road in the south and west to form the Tana River delta ('Nature Kenya- Tana Delta,' n. d.) (Figure 1). It has an area of 35,375.8 square kilometers and a population of 240,075 according to the 2009 census ('Population and Housing Census' 2009) and its capital Hola (also known as Galole) is also the largest town in the county.

Rainfall is erratic, usually occurring between March and May and again between October and December.

Tana River County was selected as the study area due to its unique biodiversity and it is also one of the newest Ramsar sites (wetlands designated as being of international importance under the Ramsar Convention) in Africa. Tana River County exists in two parts, one part is the hinterland, which is mostly rangeland, and the other part has riverine and delta areas which include palm savannas, grasslands, sand dunes, mangroves, forests and beaches and activities such as farming in the more fertile areas and fishing by the river and flood plains. The hinterland has majorly degraded grasslands with large tracts of land consumed by the invasive species *Prosopis juliflora*. This is where pastoralism is dominant.

Deltas are important for a wide range of activities such as agriculture due to the extremely fertile soils found in the sediment-rich area. Companies such as Tana and Athi River Development Authority (TARDA) and Mumias Sugar Company Limited carry out agricultural activities in the Tana Delta with a focus on production of sugar, ethanol, rice and maize ('TARDA- Agricultural Farming in Tana River Delta' n. d.). Deltas are also popular for fishing, and the Tana River Delta is specifically home to sea species such as fish and prawns, marine turtles, diverse plant and bird species and unique terrestrial animals such as the Tana Mangabey, Tana River Red Colobus and the White Collared Monkey. Large ports and harbours located here presents increased trade opportunities. Thus, more industries are highly likely to be set up in the area thereby presenting risks of pollution and reduction in open lands, both of which will pose a threat to this wetland.

Figure 1: Map of Tana River County with demarcations showing the sub-counties, major roads and market centres.



5 Methodology

This study adopted a participatory approach where data was constituted using various qualitative research methods. The research methods used included focus group discussions (FGDs), workshops and key informant interviews as well as ad-hoc interviews and documentary research.

Each of the FGDs involved approximately 11 people. The first focus group consisted of a mix of interest groups such as NGO and IGO representatives, county officials, county directors and community members. The second focus group consisted of only community members with a minimum of three people from each of the three sub-counties within Tana River. Of the three representatives from each sub-county, there was at least one woman represented for gender inclusivity, and a separate FGD was also held with these women to gain a gender perspective on the project's study questions.

Two workshop sessions of approximately 15 people each were held: Participants included representatives constituted in the same way as from the first FGD where county officials, community members, county directors, NGO and IGO representatives were all present. Ten key informant interviews were also conducted using an interview guide prepared from the project's objectives. This allowed the interviewer to clarify any questions of which the respondents did not have a clear understanding, as well as engage in deeper exploration of particular topics that may have arisen during the interviews.

General observations and other informal ad-hoc interviews were used to collect additional data on the study area, its people and their views and perceptions. This study has also used information and material from a review of documents related to this subject matter to build on the literature review and provide further insights on the study subject.

6 Findings

6.1 Approaches for improving ecosystems management

The draft Community Land Bill (2015) in Kenya deals with aspects of recognition, protection and registration of community land, management and administration of the same, special rights and entitlements, settling of disputes related to community land and environmental and natural resource management. Once passed, and with a concrete framework where all stakeholders are engaged, this bill will fill the existing legal gaps that have made the pastoralist community vulnerable over the years.

In Tana River County, traditional institutions are still present but without much government support due to lack of clear legal guiding policies. The Peace Initiative Committee is one such institution; the chairperson indicated the initiative resulted from the pastoralists' proposal of a grazing committee that they can use to enlighten and support each other in different ways, including information exchange on better ways to sustain their livelihoods.

The Peace Initiative Committee has been greatly successful in assisting with security issues for the pastoralists and ensuring peaceful interaction between the pastoralists living within Tana River County. However, we lack funding to support our movement to the areas of conflict and we are also in great need of armed escorts when we venture into the conflict areas where we usually find the invading pastoralists from areas away from Tana River and they are usually armed.

—Peace Initiative chairman

The Peace Initiative Committee chairman also articulated the county government's support and participation in various occasions, for example during outbreaks of livestock diseases, as was the case during an outbreak of foot-and-mouth disease. In addition, the county government under the department of livestock and fisheries provides mobile vaccination services, where livestock officers follow pastoralists to their areas of grazing to provide vaccination for their animals. Pastoralist education and awareness raising exercises are also implemented during such undertakings.

In one of the key informant interviews, an officer from the National Drought Management Authority (NDMA) expressed that the authority provides support to pastoralists by providing information on areas that experience rainfall, the various existing and functional water points, areas that are insecure and the drought patterns.

We as the NDMA have a resilience department and various officers serving under different capacities. Information officers compile the information that is generated from the 15 monitoring sites and in the case of a severe impact on pastoralists in a particular place within the county, response officers are sent out. In sharing this information with the pastoralists we help them make better informed decisions on their mobility and grazing patterns. It also helps them avoid disease- and drought-prone areas.

—NDMA officer

Participatory rangeland planning is one of the approaches used by NGOs and interested government authorities who are keen on working with the pastoralist community and other communities living in Tana River County, but with different livelihood sources. This approach allows for better management of natural resources found within the county and ensures that the community members are present when information and strategies on sustainable natural resource management is being shared to allow for their input and involvement in the formulation of action plans.

Communities living in rangelands should be able to benefit from the natural resources in the rangelands, and as long as they are involved in the planning and they are allowed to use these resources sustainably there is a greater chance that they will continue to provide protection and sustainable management.

—Pastoralist from Workshop I

Even though ensuring sustainable use of natural resources in a pastoral system, while still averting conflicts remains a big challenge, community members expressed that with their willingness to work together in the equitable sharing of these resources, progress can be made in this area.

As long as we don't feel sidelined and as if all the government and NGO focus is on the pastoralists we can work with them amicably to avoid conflict and share the resources within the county. Our only problem is that we always feel sidelined and bullied by these pastoralists who come to water their livestock by the rivers by driving their livestock right through our crops. Nobody can stop them because they are armed. So where we can, we frustrate them and block their access to the river to protect our farms which are our source of livelihood.

—Farmer from the women's focus group discussion

Other challenges faced in pastoral systems include the presence of wildlife which presents the problem of human-wildlife conflicts and spread of communicable diseases from wildlife to livestock and at times to humans. Dryland ecosystems such as that of the hinterland in Tana River County support not only pastoral livelihoods but also wildlife populations and game hunters.

The threats that face extensive livestock herding also affect tourism development; issues such as land sub-division, changing land tenure systems and the expansion of crop farming all lead to less available land for wildlife, resulting in increased incidences of poaching and blockage of wildlife migratory corridors. This has been a problem for the Kenya Wildlife Service (KWS) officers who grapple with these challenges and others on a day-to-day basis.

It is really hard to convince the community to protect the wildlife when issues of compensation take so long to be dealt with and the bureaucracy involved makes the whole process a big frustration. However we continue to encourage the community members to protect the wildlife and to form community groups that can work with the chiefs so as to ensure the compensation process is effective.

—KWS Research Assistant

Despite the challenges faced by KWS officers, they continue to work towards their pledge to protect the wildlife and the communities living in the area from wild animal attacks.

We take part in trying to improve the compensation process and in protecting agriculture and livestock against destruction by wild animals. We also provide conservation education and we hope in doing all this we can reduce the incidences of human-wildlife conflict.

—KWS Assistant Warden

Many of our respondents indicated that it is important to broaden the pastoral livelihood system, not only through improved pastoral land management, but also through the development of complementary livelihoods such as ecotourism and value addition of livestock products and other natural products found in these areas (Gibbons, Roba, and Mahadi 2013). The stakeholders believe that more resilient communities and livelihoods can be built as a result of this.

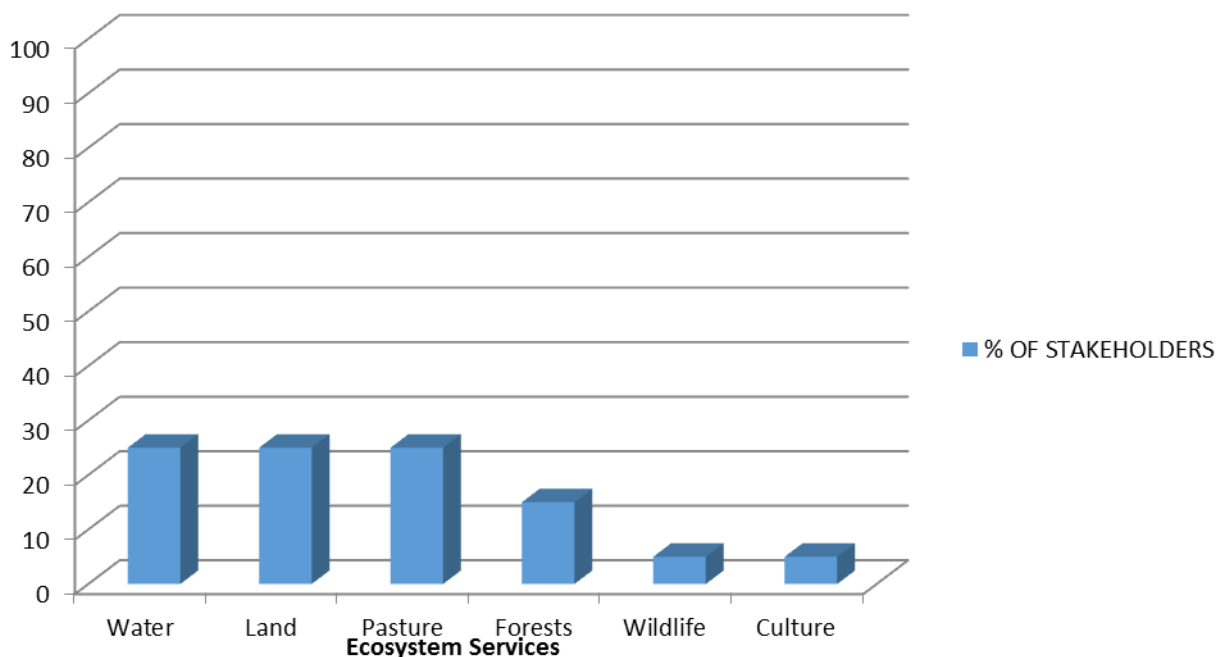
6.2 Threats facing the ecosystem services in Tana River County

Ecosystem services refer to the range of resources and processes supported by the ecosystem and relied upon by humans. The values of these ecosystems can be direct such as provisioning services, and indirect such as supporting and regulatory mechanisms or as existence values such as the cultural or aesthetic benefits.

These goods and services from dryland ecosystems benefit not only communities living within that particular ecosystem but also those living outside the drylands. This especially relates to the livestock products, such as milk and meat, that reach external markets and contribute to the national economy. Regulatory services also have far-reaching effects that can be positive if the ecosystems are well conserved. When they are not well managed, communities living within the drylands and those living far away can be adversely affected.

During meetings with the various stakeholders, provisioning services were identified as most important, where water, land and pasture were listed to be of utmost importance. Forests, wildlife, tourism and cultural services were also listed as priority ecosystem services, but not by all the stakeholders (Figure 2).

Figure 2: Ecosystem services preferences based on the proportion of interviewed respondents.



The ecosystem works as a system with components that contribute to the full functioning of the system. A threat or interference experienced in any one of these components compromises functionality of the whole system. Threats include over-exploitation of resources, uncontrolled human settlement patterns, farm encroachment, pollution, bush encroachment, inappropriate grazing patterns, flooding, land degradation, human–wildlife conflicts, climate change and non-native species invasion amongst others.

During the workshops, FGDs and key informant interviews, community members, county and national government officials and NGO representatives in Tana River County identified known natural resources and ecosystem services, the threats and challenges facing these resources and services and the ecosystem services each stakeholder was keen on protecting. Table 1 shows a list of the known ecosystem services in Tana River County categorized as per the Millennium Ecosystem Assessment (2005), potential threats facing each service and stakeholders most interested in sustainable use of each ecosystem service.

Table 1: Priority ecosystem goods and services in Tana River County, threats facing each and stakeholder interest groups¹

Millennium ecosystem assessment	Goods and services	Threats	Stakeholder interest	
Provisional services	Food	Land degradation	P, F, C, N, W	
		Deforestation		
		Over-exploitation		
			Urbanization	
	Pasture		Grazing patterns	P, C, N
			Mobility patterns	
			Climate change	
			Human-wildlife conflict	
			Over-exploitation	
			Farm encroachment	
	Forests		Deforestation	C, N, W
			Over-exploitation	
			Urbanization	
			Human settlement patterns	
			Farm encroachment	
Regulatory services	Water	Deforestation	P, F, C, N, W	
		Upstream over-exploitation		
		Climate change		
		Pollution		
	Climate regulation	Deforestation	C, N	
		Urbanization		
	Disease and pest control	Flooding	P, F, C, N, W	
		Bush encroachment		
	Carbon sequestration	Deforestation	C, N	
		Land degradation		
Mining				
Water and air purification	Deforestation	P, F, C, N, W		
	Land degradation			
	Mining			
Waste decomposition	Deforestation	C, N, F		
	Climate change			
Supporting services	Soil formation	Grazing patterns	P, F, C, N	
		Land degradation		

¹ Stakeholder list

P - Pastoralists

F - Farmers

W - Women

C - County government

N - NGOs & IGOs

Millennium ecosystem assessment	Goods and services	Threats	Stakeholder interest
		Deforestation	
		Urbanization	
	Nutrient cycling	Land degradation	F, C, N
		Deforestation	
		Cropping/farming	
		Flooding	
	Pollination	Deforestation	F, C, N
	Flood regulation	Human settlement	P, F, C, N
		Urbanization	
Cultural services	Spiritual purposes	Urbanization	F, P
		Deforestation	
	Historical importance	Deforestation	C, P
	Cultural practices	Human settlement patterns	C, F, P
	Recreational purposes	Deforestation	C, F, W
		Urbanization	

Major threats facing the ecosystem in Tana River County

Flooding

Flooding is a common occurrence in Tana River County due to the low-lying nature of the county and heavy rainfall in the upstream areas of the Tana River. According to one of the respondents, flooding in the county has often resulted in deaths of human beings, livestock and biodiverse flora and fauna. Flooding can however be controlled by the presence of wetlands and marshes as opposed to using dams and dikes. Wetlands store flood waters that overflow from either water bodies or from surface water accumulated arising from precipitation. This protects both the land and property from the effects of flooding. Without wetlands greater economic costs are usually experienced.

Stakeholders in Tana River County mainly proposed planting of trees and other vegetation to slow down speeds of flood water. One farmer from Garsen sub-county expressed that they practice 'flood recession farming', a common practice aimed at making use of floods. They then resume their normal rain-fed or irrigated farming as they wait for the next flooding season.

Local stakeholders prefer these kinds of approaches more than building of dams or dikes, an approach used in the upstream zones of the Tana River and that has affected the downstream water users who receive less and less water each year.

Land degradation

Land degradation is evident in most parts of Tana River County. One of the respondents, a farmer, during one of the FGDs, attributed this degradation mostly to livestock overgrazing and lack of proper herd management.

Pastoralists in this area graze on pasture around their settlements and in far lands. However, in the event the pasture declines, due to over-use, grazing begins to degrade the land to the point of depleting all the vegetation and this leads to erosion due to the loss in plant cover.

—Garsen farmer

An NDMA officer, on the other hand, shared similar sentiments with the livestock county director where they both attributed land degradation to haphazard distribution of water points, which have attracted spontaneous settlements around these areas leading to all-year-round grazing that eventually degrades the land. The construction of these water pans is mostly done by NGOs with an aim to increase water access for the local community, but better planning is required for this.

Stakeholders at the workshops and in the FGDs suggested destocking, as a herd management strategy, fodder farming and feed storage. The approach of destocking, they said, envisions bringing livestock numbers down to more manageable numbers so as to avoid over-use of pasture and to give naturally occurring vegetation some regeneration period.

This approach was, however, strongly opposed by the pastoralists present since within the pastoralist community culture, keeping large herds of livestock is considered important and seen as a sign of wealth. These pastoralists also seemed reluctant in adopting fodder farming and feed storage, stating that they believe pasture should occur naturally and not through these kinds of proposed interventions.

Since the old days our fathers did not plant grass and yet they still managed to feed their large herds of livestock with ease. They only needed the cultural systems to ensure fairness to all pastoralists with regard to pasture access. There was always enough and when it wasn't enough they would move with their herds and seek permission from other clans to access their pasture and water. The presence of farmers and urbanization is what has taken all this away from us and hence the degradation which is being witnessed and which is inevitable since we are required to sustain our large herds using the little land left available.

—Elderly Pastoralist from Workshop I

Deforestation

Charcoal production is one of the leading contributors to deforestation and carbon emissions. Deforestation affects the regulatory ecosystem services at a global level and is also a threat to the local ecosystem. The Kenya Forest Service (KFS) responds to this challenge by providing seedlings to schools and institutions to encourage afforestation.

We, as the Kenya Forest Service (KFS), have been working to regulate the cutting down of trees for charcoal to only the invasive species, *Prosopis juliflora*, so as to protect the indigenous trees from being felled and burned for charcoal. We issue licenses to the community members and groups who are legalized to carry out the charcoal trade with strict adherence to the set rules and regulations. These interventions are however not without challenges since indigenous trees still get felled for charcoal.

—KFS enforcement officer

In one of the key informant interviews and at the community FGDs, a local community leader reiterated that despite the sanctions levied by KFS on trading charcoal produced from indigenous tree species, the practice is still widespread because the indigenous trees produce better quality charcoal compared to other tree species. Recognising this, KFS implements different strategies aimed at curbing these unlawful acts without much success.

In an area where wood fuel is the most common source of energy in the home and charcoal is burnt for sale to support the livelihoods of the Tana River people, deforestation remains one of the greatest challenges and threat facing the Tana River ecosystem. This is made worse by the increasing population of people in the area over time which will mean more pressure to the existing natural resources.

—Ecosystem conservator

Crop farming

Tana River County is also home to farmers, mostly in the lower parts nearer the delta. In the FGDs and in the first workshop, farmers expressed that they experience numerous challenges such as livestock and wildlife encroachment into their farms, trampling of their crops by livestock and wildlife, and conflict with the pastoralists due to lack of clear land demarcations and lack of title deeds to prove ownership of their lands. These challenges pose constant threat to their livelihoods with some farmers resorting to alternative sources of income, such as hunting, fishing and sale of crocodile eggs.

A research assistant from KWS mentioned that due to the close proximity of farmers' settlements to the forests, there is increased tree cutting for domestic purposes, such as for fuel wood, and other times for building materials.

The deforestation occurring near the rivers is leading to complete destruction of the forest and relevant laws have to be enforced if the primates here are to have any habitat left.

—KWS research assistant

One of the women farmers also said that in an attempt to create parcels of land for farming, they clear bushlands and sometimes encroach into the forests. This, she said, was due to the increasing population and decreased availability of land over time. She said that many of her fellow farmers have settled along the rivers to support their livelihoods despite the increased pressure this puts on the water resources.

The wetlands in this area are also important in storing flood waters which ensures continuous availability of water and the continued function of carbon dioxide absorption. However, farming, which occurs widely around the riverine areas and wetlands, depends upon these stored water reserves.

One of the women farmers in a FGD stated that even though their small-scale farming depends on water resources available, they do not use a large percentage of the water resources as compared to the large-scale agricultural schemes, such as the Tana and Athi River Development Authority (TARDA). She expressed her fear that over time there will be a risk of changed water balance of the delta resulting in the loss of functionality of the wetlands due to the ecosystem damage that will be caused by these large scale agricultural schemes.

Urbanization

Development projects and urbanization threaten the environment and its stability. Tana River County is of no exception with dams and irrigation plants running under TARDA. Farmers and pastoralists alike stated in the FGDs that these development projects in the county have significantly reduced the share of land available for farmers and pastoralists, causing the latter to adapt a more sedentary approach to herding.

Fodder production is one of the ways herders can get food for the livestock without the presence of extensive systems and they therefore do not have to worry about limited land availability.

—County director livestock

Farmers living closer to the delta also stated that there is over-exploitation of water caused by the large uptake of water by the dams and irrigation plants that take up most of the available water for their schemes and only allow water flow to the community farms once they have accumulated enough for the schemes and dams. However, TARDA states that they use the irrigation schemes and dams as a measure to control and maximize benefits from flood water for the greater good.

Human–wildlife conflict

Human–wildlife conflict is a threat and an issue affecting all stakeholders. Pastoralists in this study mentioned that they have suffered major losses when wild animals attack their livestock either in their settlements or when they are out in search of pasture. Farmers also experience this challenge; baboons and monkeys from the neighbouring forests damage their crops, creating losses and constant anxiety whenever they fail to have someone to watch over their farms.

The community members stated that due to this conflict, tension and frustration leads them to kill wildlife which is a tourist attraction and a possible source of income for the county.

We have intervention measures aimed at responding to animal attack threats within the villages and this has helped to reduce the existing human–wildlife conflicts.

—KWS officer

The mix of livestock and wildlife also poses a threat of diseases spread from animal to animal. However, the KWS veterinary department and the county livestock department engage in managing the spread of diseases and carry out treatments and vaccinations.

6.3 Management options for maintaining and improving ecosystem services

Appropriate management options can help to preserve the integrity of the ecosystem and maintain the services it provides. In Tana River County, a range of management options and interventions are in place to ensure enhanced ecosystem services, while other management options are still under consideration. An insight into the management options that are in place in Tana River County and that are aimed at maintaining and enhancing the value of ecosystem services provided is presented in Table 2. These options are further described based on preferences among the stakeholders.

In this table, all stakeholders with a preference for a particular management option are listed under the preference list, while those stakeholders who did not agree with and were unwilling to implement the particular management intervention are listed under the non-preference list. Feasibility ranking was also done for each of the proposed interventions.

Table 2: Proposed management interventions, the related feasibility ranking and stakeholder preferences

Ecosystem resource	Management option/intervention	Stakeholder preference of interventions ¹		Feasibility ranking ²
		Preference list	Non-preference list	
Water	Establishment of water storage facilities (e.g. water pans, dams, rainwater harvesting)	P, C, W, N, F	-	3
Rivers	Construction of animal troughs	P, C	-	3
Lakes	Opening up of 'malka' ³ corridors	P, C	F	5
Rainfall	Water catchment rehabilitation and protection	P, C, W, N, F	-	3
	Water purification	P, C, W, N, F	-	3
	Fish farming	F, C, N, W	-	3
	Flood recession farming	F, C, N, W	P	5
	Tree planting	C, N	-	3

Ecosystem resource	Management option/intervention	Stakeholder preference of interventions ¹		Feasibility ranking ²
		Preference list	Non-preference list	
	Strengthening of water utilities and water committees	P, C	-	5
Land	Adherence to grazing patterns/rotational grazing	C	P	1
Food	Reservation of pasture areas for the milking herds	P, W, C	-	5
Minerals	Pasture management committees	P, C	-	5
Carbon sink	Feed storage	C, N	P	3
	Fodder farming	C, N	P	1
	Destocking	C	P	1
	Value addition of <i>Prosopis juliflora</i> to produce fodder	C, N, P, F	-	3
	Clear policies on land use and grazing management	C	P	3
	Reseeding	C	P	1
	Enclosures	C, F	P	3
	Integrated farm management practices	C, F	-	5
	Population control measures	C	P, F	1
Pasture	Provision of fertilizer and pest control subsidies for pastoralists to venture into farming	C, F	P	1
Livestock				
Wildlife	Construction of storage facilities for fodder production	C, P	-	3
	Alternative livelihoods	F, C, N, W	P	3
	Capacity building and sensitization of pastoralists on effects of their activities on the environment	P, C, N	-	5
Forests	Community forest organizations	C, N	-	5
	Restriction on charcoal burning	C, N	-	3
	Re-afforestation	C, N	-	3
	Empowerment of WRUAs and CFAs	C, N, F	-	3
	Forest importance and awareness creation	C, N	-	3
	Law enforcement and forest surveillance	C, N, F	-	3
	Advocacy for change of land tenure	P, F, C, N	-	3
	Income-generating activities	N, C, W	P	3
	Irrigation of tree seedlings	N, C	-	1
Wildlife	Knowledge sharing on the importance of wildlife	C	-	3
	Fencing around wildlife areas or on farms to protect crops and animals	C, F	-	1
	Establishment of community-based conservancies	C, F	-	3
	Law enforcement and wildlife surveillance	C, P, F	-	3
	Community empowerment and education on wildlife importance	C	-	3
	Animal control to avoid conflict	P, F, C	-	3
	Alternative wildlife farming	C, F	-	3
	Habitat rehabilitation	C	-	1

Ecosystem resource	Management option/intervention	Stakeholder preference of interventions ¹		Feasibility ranking ²
		Preference list	Non-preference list	
Culture	Income-generating activities	C, F, N	P	3
	Opening of wildlife corridors	C, P, F	P	3
	Reduced family size to reduce pressure on wildlife resources	C	P, F	1
	Strengthen traditional economic activities	F, P, C	-	3
	Equality on resource sharing and representation among the communities	F, P, C	-	1
	Establishment of resource centres	C, F, W	-	3
	Introduction of cultural education in the school curriculum	C	-	3
	Protection of cultural sites by WRUAs and CFAs	C, N, F, W	-	3
	Exposure visits to cultural sites	W, C	-	3
	Publicity and promotion of the local culture	C, W, F	-	3

The likelihood of successful implementation of each intervention is measured by the feasibility rank where 5 is the intervention with the highest likelihood of successful implementation, 3 is the intervention with a 50/50 chance of successful implementation and 1 is the intervention with the least likelihood of successful implementation. These proposed interventions were each targeted at specific ecosystem services and natural resources but some of the approaches cut across several ecosystem services. These feasibility rankings were derived from the total value obtained for each management option based on ranking criteria described in table 3.

Table 3: The ranking criteria used in rating the feasibility of a particular management intervention

Ranking criteria
Low costs
Technical ease
Likelihood of government support
Ease of securing community support
Strength of impact
Quick delivery of benefits
Benefits to a wide range of people
Likelihood of failure (reliability)
Positive effects on multiple ecosystem services

The matrix on Table 3 was used by stakeholders to value the management options in order of the most to the least feasible one and in doing so, provide a final feasibility ranking for the various management options that they came up with. A value of 1, 2 or 3 was given in Table 3 based on how well a particular management option met each of the ranking criteria.

Ecosystem services priority listing and management options

Water

Water was listed as the most important of all ecosystem services by all stakeholders.

Water is important as a primary good for the community and for our livestock.

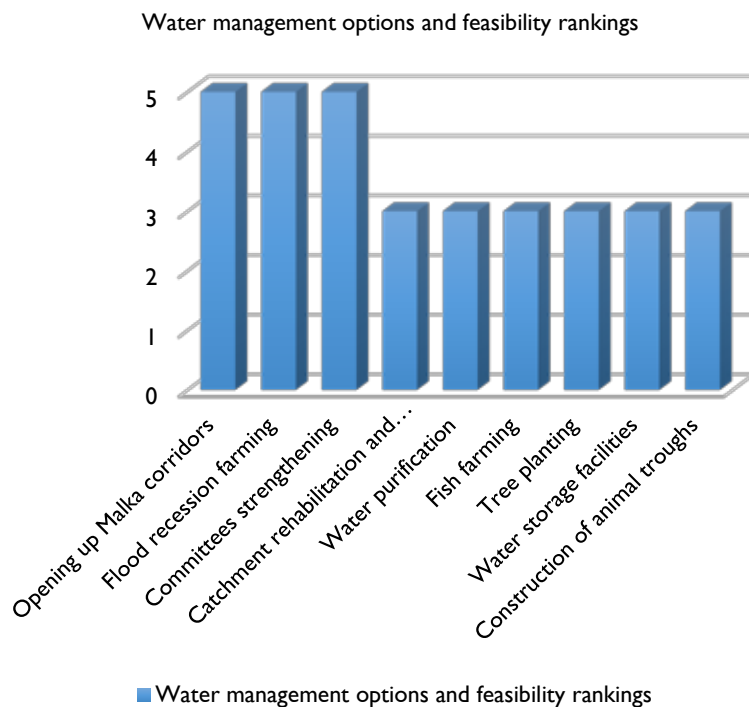
—Pastoralist

Water serves all our domestic needs and is very important for our crops.

—Farmer

The figure below gives a summary of water management interventions as proposed by stakeholders, for enhancing water as the main important ecosystem resource in Tana River County.

Figure 3: Suggested management options to enhance the value of water resources and the feasibility ranking of each option.



Water is a major provisioning service of the ecosystem and when well utilized it benefits a large number of inhabitants. Building of canals was suggested as one of the ways to prevent loss of water through excessive flooding of river water. The water diverted will in turn be used for farming and irrigation and most of the water will be put into good use as opposed to losses associated with flooding. Tree planting was also suggested as a way of utilizing the excess flood waters at river points.

However, this management strategy is threatened by dams that have been built upstream to generate electricity and for irrigation which has consequently resulted in reduced water supply for the communities living downstream. Fishermen and farmers particularly raised their concerns regarding these upstream dams, stating that they greatly depend on the flood water draining downstream for their fishing and farming activities.

It was suggested that water pans should be widely constructed and distributed within the county especially in the areas further away from the settlements, to allow pastoralists to move their herds widely so as to avoid concentration of livestock around a particular water point. This is envisioned to reduce erosion and trampling around rivers and also give vegetation around the water points sufficient time to regenerate.

'Access to water is always the reason behind large numbers of people settling around water points', said one of the FGD respondents. The county government noted that it has put efforts towards assisting the community members with this challenge through services such as water trucking to the pastoralists grazing far away from water points, pumping of water from rivers to areas of settlement for easier access to the community members.

Other interventions proposed by the county government included (1) fencing off areas around water pans and boreholes are to control the use of these facilities and (2) assisting the community to set up water committees that are in charge of water management and water use control. These approaches, they said, will ensure that the water resources are protected and used sustainably. However, it was widely felt across all the stakeholders that bigger water pans were required in the area to better support both the pastoralists and agro-pastoralists.

The county government has also been involved in water, sanitation and hygiene (WASH) programs which have built latrines to reduce river water contamination by human waste. This has helped preserve the water quality of the water bodies and water pans in the county and it has led to reduced disease exposure to contaminated water.

Land

Some of the respondents suggested that provision of title deeds to individuals living in Tana River County will lead to responsible and sustainable use of the natural resources since the land will no longer be seen as a common good with free-for-all use that leads to resource over-use. Title deeds, they said, will also help demarcate areas and reduce conflicts between farmers and pastoralists over issues regarding access to land.

County officials and NGO representatives agreed with community members that working on land governance issues and provision of title deeds will greatly help increase overall responsibility and care of land as a resource, especially among pastoralists who use pasture widely with no one taking particular responsibility to ensure no irreversible damage is done.

The land boundaries and land governance process is ongoing but no particular resolutions have been set nor any laws passed. The Community Land Bill of 2014 is still under review. Once passed, it is envisioned that these bills will allow adoption of the long-standing and effective community rules and penalties pertaining to natural resource use that brought about amicable living in the past. Currently there is no law or constitution to guide the preferred pastoralist traditional courts that have long been used in pastoral areas such as this, making enforcement of the rules and penalties difficult, if not completely impossible.

Farmers suggested the incorporation of practices such as mulching using crop residues to improve the microclimate of the soil so as to increase water retention and infiltration. This, they said, will protect not only their crops during the drier times but also the land to reduce evapotranspiration occurrence. Farmers in this region also practice rotational cropping system to prevent soil nutrient depletion and this improves the quality of the soil consequently ensuring that the various supporting services carried out by soil, such as nutrient and water cycling, are maintained.

The county government and NGOs also suggested that there should be more training given to the community members regarding dry season crops that can give yields even during the drier periods. This, they say, ensures that food, as one of the provisioning services from the ecosystem, continues to be produced all-year-round to protect against hunger and malnutrition during times of drought and limited precipitation. This strategy would benefit both pastoralists and farmers living in Tana River County but there were seen to be some reservations among the community members who were not very receptive to the culture of cultivating alternative dry season crops such as sorghum or millet, citing lack of familiarity with those crops.

Other respondents suggested that value addition of food produced from the ecosystem will provide many of the community members with an incentive to manage the ecosystem better. In addition, community members emphasised the importance of access to more markets for selling their produce to increase their household incomes. This, they said, would deter many of them from engaging in destructive activities, such as tree felling for charcoal.

The NDMA respondent stated that they were involved in monitoring of changes in the ecosystem. The information obtained from this monitoring is used for better management of water and pasture resources. This is done through NDMA sentinel sites where information is collected and aspects, such as available pasture within the county, availability of water and the approximate distances to water points, land degradation caused by migration patterns used by pastoralists and other negative effects to the environment, such as extreme soil erosion, are monitored.

Figure 4: Suggested management options to enhance the sustainable use of land and the feasibility ranking associated with each option.



The representative from NDMA also stated that the authority carried out an analysis of a vegetation index using satellite imagery to aid in evaluating degradation and loss in vegetation cover, to give better advice to pastoralists on the best areas to graze. However, the presence of the invasive species *Prosopis juliflora* gives a misleading representation of the actual vegetation cover, as the general image of the county appears 'all green', leading to the assumption that the county has a high vegetation cover that can be used as pasture when that is not the case.

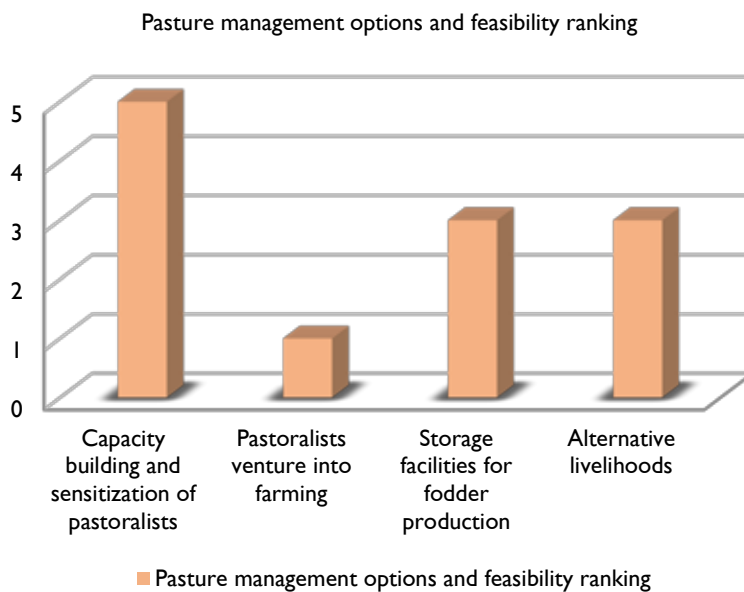
Some respondents also highlighted the need to regulate mining in the county, to ensure responsible mining activities. These respondents said that open pits are usually left behind after mining has taken place, posing a great risk of death, injury or even drowning of animals and human beings due to water accumulated in these pits.

Pasture

NGO representatives said that they have introduced cultivation and farming to pastoralists as an alternative livelihood source. The concept of pasture farming has also been introduced by the county government as a strategy to buffer the pastoralists' livestock during the drier seasons. These approaches, however, have not been keenly adopted due to fears by local pastoralists that other pastoralists from the surrounding counties will invade and graze on these pasture farms. The county government therefore has to come up with measures to ensure the security of the pastoralists living in Tana River County and to protect them from the invasion by the neighbouring pastoralists' community.

Pasture and fodder farming is one of the approaches promoted by the county government. The livestock county director mentioned that the livestock department is working in collaboration with the County Livestock Marketing Council to raise awareness on the importance of this approach especially to pastoralists who lose their livestock during drought occurrences. He said, 'If successful, this strategy will ensure that pasture and feed are always available to livestock regardless of the season and this will also reduce over reliance on naturally growing pasture giving it a chance to regenerate and re-establish'.

Figure 5: Suggested management options to enhance the sustainable use of pasture and the feasibility ranking associated with each option.



Establishment of migratory routes, also known as 'malka' corridors—paths used by livestock during grazing and watering, particularly to access the river—was suggested as a way of controlling pasture use within the county as the herders can be directed on a rotational use of pasture to allow used pastures a chance at regeneration.

It was also suggested that there is a need to create more awareness among the pastoralists regarding the compensation laws for livestock loss during drought times.

Currently a majority of the pastoralists believe that the more livestock numbers they hold the more the compensation they would get from the government in the occurrence of a drought. This notion has made it difficult for pastoralists to adopt destocking as one of the measures of protecting pasture, land and water resources.

-County livestock director.

The livestock department further stated that they carried out supplementary feeding during severe droughts; giving pastoralists concentrate feeds and mineral blocks. The livestock department also engages in and trains the pastoralists on reseeding as a strategy to maintain their pasture all-year-round. The adoption has, however, been slow, according to the livestock county director, which he attributes to pastoralists' view of this approach as more time consuming and labour intensive, compared to moving their livestock around in search of pasture. This department also engages in production of seeds of perennial grasses that are commonly used for reseeding.

The County Land Management Board is responsible for controlling the migration of livestock within Tana River County to control pasture use within the county and ensure sustainable use by both the sedentary and migrant pastoralists. This board has also been responsible in solving land conflicts between pastoralists and also between pastoralists and farmers by educating them on their rights to land and working with the community on mapping out

land boundaries. This has resulted in better cooperation among the community members and it has also brought about a sense of security which has resulted to better use of the land and the natural resources available.

Pastoralists said that they still maintain the use the dry-and-wet-season grazing systems as an approach to sustainable use of water and pasture.

Forests

Some community members suggested that in order to protect the forests and the ecosystem services derived from them, forests need to be protected from damage and destruction by the larger mammals such as elephants. The ecosystem conservator said that further to this, there are directives and laws in place to ensure that charcoal is only produced from *Prosopis juliflora* and not the indigenous trees. This he said will go a long way in supporting and preserving the regulatory role that indigenous trees play within the ecosystem such as air purification, erosion control, flood control, climate control and water regulation.

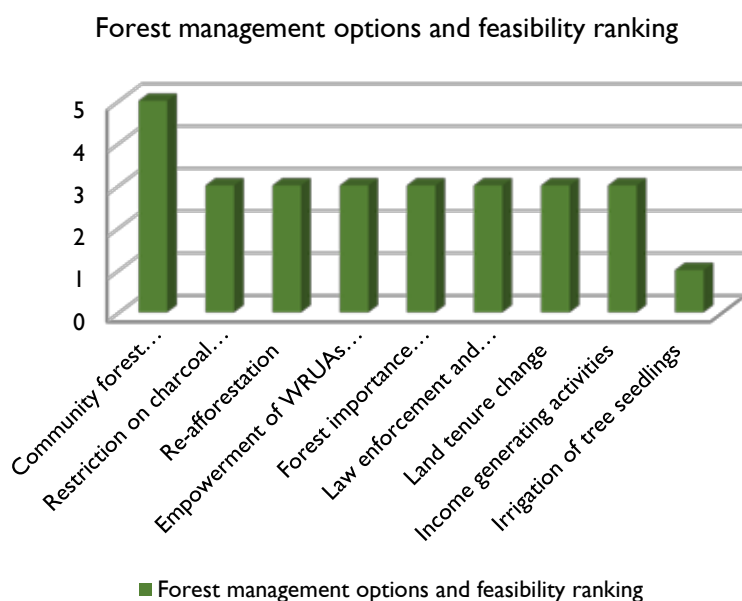
Government and NGO training sessions were also suggested to allow community leaders to share knowledge and information on importance of sustainable resource use and introduction of alternative livelihood sources. This will provide alternatives to steer the community, away from activities that lead to over-use of natural resources such as for charcoal production. Beekeeping was one such suggestion as an alternative livelihood source.

The strengthening of community forest associations (CFAs) in forest management was suggested as one of the better participatory approaches that work better in forest conservation compared to forest policing which alienated the community members leading to more forest destruction and conflicts.

Tree planting exercises were mentioned as beneficial in improving the forest coverage in the county. These exercises are currently being implemented by KFS, which supply schools, other institutions and community groups with tree seedlings to increase the tree cover. This has given substantial results such as better controlled soil erosion, flood control, improved air quality and shade for human beings and their animals.

In addition, planting of fruit trees is an approach with the dual benefit of achieving the regulatory and provisioning services from trees. Fruit trees such as mango, pawpaw and coconut are common in Tana River County. These fruit trees provide an alternative source of income for the community leading to reduction of poverty in the area. Such practices are encouraged to slowly move the communities from destructive practices such as charcoal production using indigenous trees.

Figure 6: Suggested management options to enhance the sustainable use of forests and the feasibility ranking associated with each option.



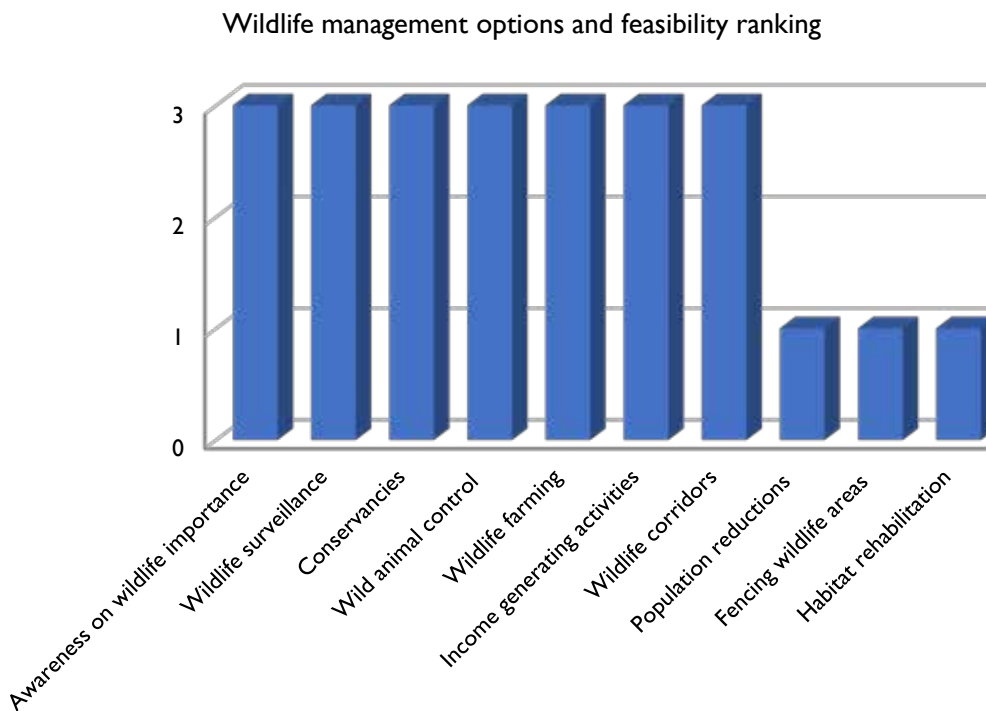
Wildlife

To prevent over-use of available forage and reduce competition for pasture, sustainable management of wildlife populations was suggested as a viable option that would help in maintaining sustainable wildlife numbers without causing harm to the other ecosystem components.

One of the propositions made by the community stakeholders was a request to KWS to issue licenses that would allow them to participate in wildlife farming for animals such as crocodiles and ostriches, to diversify their income sources.

The KWS warden said that wildlife conservation education to sensitize the community on the benefits derived from wildlife such as food, skins and hides and eco-tourism has been and continues to be an approach used to change the communities’ perception of wildlife as only beneficial to government bodies such as KWS. Faster responses to animal threats and concerns as raised by the community from time to time has helped KWS to gain the confidence of the community and this led to better participatory wildlife conservation by the community. Community compensation following wild animal attacks is also another approach that was suggested by the local community members who said that they lacked the proper knowledge on how to file for compensation as a result of losses suffered from wild animal attacks.

Figure 7: Suggested management options to enhance wildlife as an ecosystem resource and the feasibility ranking associated with each option.



The more indigenous trees give cultural services to us as the communities living in the area. We use these natural resources as a way to educate the children in the community and also for religious ceremonies.

—Middle-aged woman from the southern part of Tana River County

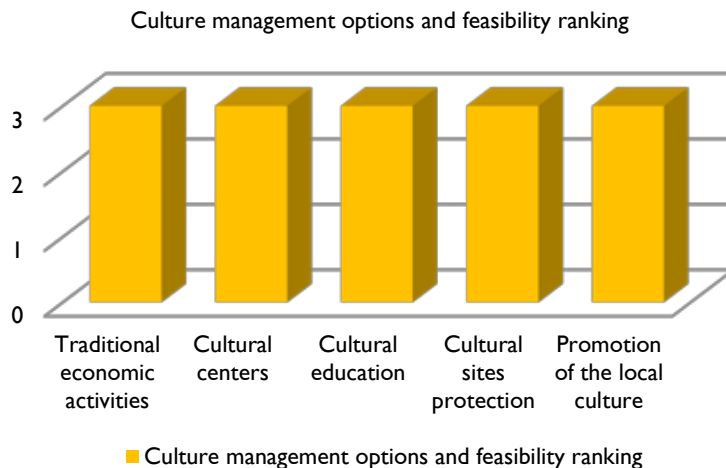
Community members proposed putting up of fences to help control the movement of wild animals and for the establishment of conservancies to better manage the wildlife populations, to reduce the human–wildlife conflicts. The community members also proposed more engagement with conservancies and KWS to show case their culture and engage in trade of cultural artefacts and ornaments.

Culture

As an approach to protecting their culture and associated natural resources, community members suggested that improved ease in accessing of business loans would provide them with a means of attaining an alternative income.

There were also suggestions which centred on formation of income-generating projects such as community hotels to generate funds that could then be used in other community projects related to health, education, water and sanitation and livelihood support.

Figure 8: Suggested management options to enhance culture as an ecosystem service and the feasibility ranking associated with each option.



6.4 Interventions protecting ecosystem services not ‘on the radar’ of local stakeholders

In addition to the management options suggested by stakeholders, there are other approaches that could be used in managing natural resources such as land, forests, wildlife and water to enhance the value of the ecosystem services provided. Some of these management options include:

- Use of land management practices such as mixed farming, intercropping, rotational farming and soil conservation not only preserves the soil organic carbon content, but also mitigates effects of climate change, conserves the soil biodiversity and improves soil fertility and water flow regulation.
- In the bush-encroached area, use of fire as a strategy to prevent bush encroachment and promote a grass dominant ecosystem is yet another approach to sustain the land. However, in Tana River County, pastoralists were not keen on this approach and it is therefore highly unlikely it will be implemented without extensive consultation.

Their reluctance to adopt this method, they explained, is not because they do not know the effectiveness of this method but because of land rights conflicts and land ownership problems. Most of them do not own land either individually or as a communally; this means that the land is effectively open access and free for all to use. None of the pastoralists expressed willingness to create exclusions where burning can be practiced, claiming that there are already shortages of pasture for the large numbers of herds they all own.

- Protection of native vegetation to control invasive and encroaching species while destocking, to have sustainable livestock numbers and prevent effects such as bush encroachment that can arise from the overgrazing of grasslands.

However, from the FGDs, destocking was said to be a culturally unacceptable management option and therefore many of the pastoralists seemed unwilling to embrace the method. This is partly due to the insecurity and fear of invasion on their pasture lands by pastoralists from other areas.

- Practising conservation agriculture which not only minimizes disturbance of the soil but also capitalizes to maintain soil cover using crop residues from past harvest in order to minimize water erosion, increase water infiltration, reduce run off and decrease evaporation.
- Integrated pest management is important in controlling pests and diseases. This method encourages judicious use of pesticides together with natural methods of controlling disease such as crop rotation.
- Integration of eco-tourism practices within the county where the community can be involved in conservative efforts and sustainable use of the forest resources and wildlife. Providing these forms of economic incentives will ensure that the ecosystem services from these natural resources are protected.

6.5 Factors influencing implementation of best-bet practices

The feasibility of all the management options currently being practiced or that are under consideration to enhance the value of ecosystem services are influenced by several factors. The factors identified by respondents in this study are discussed below.

Funding

Availability of funding (or lack thereof) was strongly emphasized by several respondents. The county government representatives were especially concerned that mobilization of funds could be the hindrance to the implementation of management strategies that particularly require some construction activities or an extremely large financial investment. Management interventions that the respondents said were likely to suffer this setback include construction of water storage facilities, value addition of *Prosopis juliflora* for fodder, reseeding, construction of fodder storage facilities and fencing around wildlife areas.

Community traditions

In the FGDs, community members pointed out that for the successful implementation of the various management interventions, their cultural concerns and community traditions have to be taken into consideration. The management options which they felt might be contrary to their beliefs and cultural practices include feed storage, fodder farming, destocking, reseeding, population control measures and provision of fertilizers and pesticides to pastoralists to venture into farming.

Asking us to control our populations by having fewer children in order to reduce the pressure on the ecosystem is just next to impossible. We believe God is the giver of life and we therefore cannot interfere with the process.

Also asking us to change or incorporate farming as an alternative source of livelihood is just demeaning to pastoralism as a way of life. We do not have to farm to survive neither do we have to practise fodder farming for our livestock to have pasture. We will continue with our mobility. It's what we've always done and it's what we will continue to do.

—over 50-year old pastoralist

The community perception of a particular management strategy and their participation in implementing these proposed management options is important and has to be considered for successful implementation. For the management options that have a high likelihood of success but that infringe on the culture of the people, sensitization and education was proposed by the county officials and NGO representatives.

Destocking seems to be a logical way of doing things so as to reduce the overall environmental pressure and I have learnt that from the sensitization programs and educational forums. But do you honestly think that if I choose to reduce my livestock numbers that my fellow pastoralists will do the same? No. I will just be perceived as a poor man and they will keep up with their large herds of livestock.

—Middle-aged pastoralist

Technical expertise

Technical expertise will be required for management options such as construction of water and fodder storage facilities, fish farming, reseedling, law enforcement and surveillance for forests and wildlife, irrigation of tree seedlings and establishment of community based conservancies. However, the county officials in their respective capacities, KWS, KFS and NGOs all stated their willingness to provide the necessary technical expertise required to ensure full and successful implementation of the suggested management options.

Governance

Governance was brought up by respondents as a likely impediment to implementation of some management options. The kind of questions that came up included matters of resource borders versus administrative borders, who is in charge of managing a particular natural resource, who is in charge of creating and managing the strategic reserve for livestock grazing during drought periods and issues on who will be in charge of reducing the demographic pressure on land.

Some of the approaches suggested by stakeholders that they thought could strengthen governance included supporting of by-laws to uphold customary rules and regulations, building institutional capacities of local natural resource management institutions, participatory rangeland planning, multi-stakeholder dialogues of key natural resource management issues and support for opportunities for local communities to benefit from sustainable management of natural resources.

As pastoralists it would mean so much to us if the county government could provide us with security in the areas we move to in search of pasture. We also need other services such as mobile clinics so that it is easy for women to access healthcare and boarding schools for our children to easily receive education away from the challenges of the mobile lifestyle we lead. That way we do not have to worry about their safety when we leave them behind in search for pasture. This education they receive will bring about sensitization and a better say in development planning issues.

—Pastoralist

The governance interventions likely to provide an incentivized approach to the community to work towards better natural resource management include formation of micro-credit facilities, strengthening of markets, provision of basic public services such as health, education, security and strengthening of local knowledge and institutions, policy frameworks that support the extensive livestock systems and communal land tenure with local rules and regulations.

I strongly believe security issues are strongly related to the environment. I have, during my time in the security forces, seen heavy land degradation in the more secure areas as the herders congest around the area and conflicts arise as they all fight to control the area refusing to move to the less secure areas. I believe if we give the pastoralists security the conflicts amongst themselves and between them and the farmers will greatly decrease as the less explored areas will be available and safe enough to graze their livestock in.

—Security officer, KPS

The table below lists the top most important ecosystem services for the Tana River County people and the organizations, authorities, institutions and committees responsible for protecting and improving the status of each ecosystem service. These institutions will therefore be important when it comes to the implementation of the proposed management options on a larger scale as the Kigaruni WRUA implements the same around its area of coverage.

Table 4: Table showing the list of stakeholders involved in ecosystem service management and their particular roles

Ecosystem service	Stakeholders	Roles in ecosystem service management at landscape level
Forests/bushland; fuel wood, building material, medicines and carbon sequestration	Community forest associations	Conservation of the forest Planting trees in the community
	Local community	Utilization of the forest Conservation of the forest
	Kenya Wildlife Service	Conservation of the forest and wildlife Policy implementation
	County land management board	Policymakers on land matters
	Water Resources User Associations	Protection of water resources Conservation of water resources Management of water catchment areas
	NGOs (e.g. Nature Kenya)	Conservation of forest Tree planting
	County department of environment	Afforestation Waste management
	National Environment Management Authority	Conservation Enforcement of regulations
	Water Resource Management Authority	Conservation and management of water resources
	County department of agriculture	Provision of services Soil and water conservation Land management
Food	County department of livestock	Provision of drugs and vaccines for livestock Conservation of seasonal grazing areas Issuing permits for livestock movements
	National Irrigation Board	Provision of water for farmers
	Community	Utilization of food Food production
Culture	County department of fisheries	Education and awareness on fish farming
	County department of gender, culture and social services	Promote restoration of social value and integration Conservation of cultural sites
Wildlife habitat	Community	Conservation of cultural sites Sustenance of cultural values
	Kenya Forest Service	Conservation of gazetted forests and bushlands
	Community	Development of community conservation by-laws (formal/informal) Involvement in conservation initiative Traditional management initiatives
	County department of wildlife and natural resources	Formulation of conservation and restoration policies
	Water Resources User Associations	Protection of water catchments

Ecosystem service	Stakeholders	Roles in ecosystem service management at landscape level
Grasslands and pasture	Community forest associations	Forest conservation in collaboration with KFS
	NGOs (e.g. Nature Kenya)	Conservation of important bird areas
	County land management board	Development of policies on utilization of public and communal land
	County water department	Rehabilitation of catchment areas
	National Environment Management Authority	Development and enforcement of policies on environmental management
	County department of livestock	Capacity building Provision of pasture seed
	National Drought Management Authority	Pasture establishment and range re-seeding Supporting livestock ministry; development of land use plans Disease control Development of grazing management plans Control of livestock migration and over-grazing
	Food and Agriculture Organization	Land governance Land use plans Financing ministry activities, especially FAO
	Regional Pastoral Livelihoods Resilience Project	Establishment of pastures Irrigation Re-seeding
	Community Grazing Management Committee	Control of livestock migration and over-grazing Development of grazing management plans Enforcement of by-laws
Water	National Government Administration Office	Security enforcement
	County department of livestock	Water provision for livestock
	Water Resource Management Authority	Regulation of and support to WRUAs
	Water Service Trust Fund	Financial support to institutions and communities
	Action Against Hunger	Development of small water structures (boreholes and shallow wells)
	German Agro Action	Provision of water structures (shallow wells) WASH activities Water pans, boreholes, troughs
	National Drought Management Authority	Community support/capacity building
	Medium-term ASAL program	Funding the development of sub-catchment management plans (SCMPs) Funding the implementation of SCMP activities
Water management committee	Community water structure management	

6.6. Gender perceptions of ecosystem values and management options

Women in rural Africa are vulnerable, facing many challenges such as limited access to financial and technical resources and often facing difficulty in acquiring land. When they do get ownership of land, it is often over-used land which provides lower yields and quality than that owned by men.

In Tana River County many of the women practise farming in order to support their households. Their increased engagement in farming has been caused by the migration of working-age males to urban centres to look for casual or semi-formal jobs, leaving many women behind to tend to the agricultural activities around the home. These women farm rice, maize, cash crops such as cashew nuts, vegetables and fruits, such as bananas and mangoes.

My husband leaves for work sometimes to town further away from here, so naturally I have to find a way to provide for my children, food at least, then his money takes care of the greater financial burdens.

—A female farmer, aged 30–40

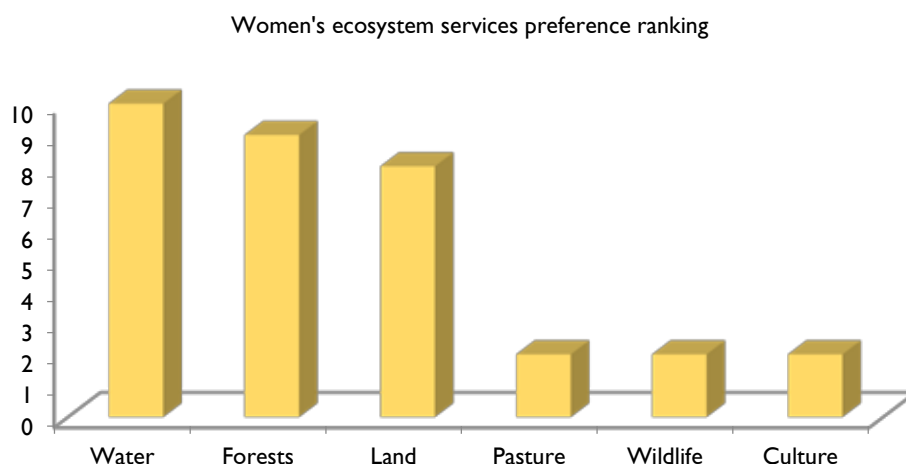
Mobile herding is primarily left for men, while women carry out a more sedentary approach to pastoralism that involves tending to calves and the milking herds from the homes. The milk obtained from these herds is for domestic use and for sale. One of the respondents shared that this was one of the ways women make some little money for themselves.

Over the years, we as women have had to farm to supplement our domestic needs and in the unfortunate circumstance where your husband fails to provide for you, you have to farm more to get enough produce for the household and for the market so as to get money for the other needs at home.

—A female farmer, aged over 50

The women who were interviewed had a good understanding of what ecosystem services were, identifying the most important ecosystem services as water, forests, land, pasture, wildlife and culture, in that order (Table 5). In this regard, it was noted that water is seen to be commonly considered as the most important ecosystem service by both the men and women.

Figure 9: Absolute count of the number of interviewed women who accord importance to each ecosystem service.



However, men and women were seen to differ on the second most important ecosystem service with the men ranking land as the second most important ecosystem service, while women ranked forests as the second most important. The women from the FGDs attributed this difference to the fact that land ownership is a right reserved for men. They further explained that forests are more important to them as women because they easily access food, spices, charcoal and building materials from them. They also said that the forests attract tourists who bring business to the towns and they buy the cultural artefacts and decorative items made by the women.

Land featured as the third most important ecosystem service for the women, more of whom practice agriculture or horticulture than men and require land for this, as well as for erecting their homes and for the few animals they look after. The women did not put a lot of emphasis on pasture and wildlife. Pasture, they said, is readily available around the homestead and is enough for the milking herds and calves and therefore, the men, who are the mobile herders, are the ones who have to search for pasture to ensure survival of their larger herds.

The women who were interviewed also accorded less importance to wildlife stating that it was the responsibility of KWS to manage the wild animals. They also said that the culture of killing wild animals has changed even though they still suffer from trampling of their crops by elephants and the everyday nuisance of guarding their farms against baboons that steal crops from the farms and food from the houses.

Another challenge cited by the women was access to the river water especially due to closing of irrigation canals by the TARDA scheme thereby restricting water movement to the small-scale farms. This problem is worsened by the lack of reliable rainfall.

Considering all other household chores the women are expected to handle, the best preferred management interventions, they said, would be those that bring water points closer to their homes and make access to water easy. They also greatly supported other interventions that would deal with compensation for the farm losses brought about by wild animals.

Other preferred interventions would be those centred on easing the process of title deed issuance so as to solve land issues amongst the communities living within Tana River County and interventions around pasture production or pasture management which the women believe will resolve the endless clashes and conflicts between them as farmers and pastoralists.

Table 5: Women's preferred management interventions for each ecosystem service in order of preference

Ecosystem service	Preferred management intervention
Water	Establishment of water storage facilities (e.g. water pans, dams, rainwater harvesting)
	Opening up of 'malka' corridors
	Rehabilitation and protection of existing water catchments
	Water purification
	Strengthening of water utilities and water committees
Forests	Re-afforestation
	Forest importance and awareness creation
	Empowerment of WRUAs and CFAs
Land	Adherence to grazing patterns/rotational grazing
	Reservation of pasture areas for the milking herds
	Pasture management committees
	Feed storage
	Fodder farming
	Destocking
	Clear policies on land use and grazing management
Re-seeding	

Ecosystem service	Preferred management intervention
Pasture	Integrated farm management practices
	Construction of storage facilities for fodder production
	Alternative livelihoods
Wildlife	Capacity building and sensitization of pastoralists on the effects of their activities on the environment
	Fencing around wildlife areas or on farms to protect crops and animals
	Establishment of community-based conservancies
	Law enforcement and wildlife surveillance
Culture	Animal control to avoid conflict
	Establishment of cultural centres
	Publicity and promotion of the local culture

Some of the challenges the women said they face include rising cost of cultivation, unreliable rainfall, canal obstruction by the irrigation schemes, access to credit and a lack of proper markets to capitalize on the sale of agricultural products.

7 Discussion

From this study it is evident that stakeholders in Tana River County, especially the community members, who are in first contact with the ecosystem services, are willing to be part of implementation of the various management interventions. This interest in protecting their ecosystem gives these interventions a greater chance at successful implementation. However, despite the stakeholders' ideas, passion and interest in protecting their ecosystem through the various approaches, they face several challenges, some that they can easily overcome and others that are more deeply rooted and require policy interventions to tackle. Land policies is one such example where lack of title deeds for individuals and community lands presents a hurdle to implementation of management options such as demarcation of '*malka*' corridors, rotational grazing practices and reservation of pasture areas.

The county government carries out community sensitization on ecosystem services and the importance of protecting the ecosystem. This is done using opportunities such as the mobile vaccination operations and village meetings. Community members welcome such systems of awareness raising used by the local county government and NGOs recognizing that it has resulted in better understanding and more equity in the sharing and management of natural resources. This has led to reduced conflict among the different communities which have different livelihood practices. Tana River County is a semi-arid area with ecosystems facing many threats including from overuse by diverse communities and population growth, particularly urbanization. Communities, government agencies, and other stakeholders are attempting to deal with these and other threats such as flooding, deforestation and land degradation through a range of interventions and management strategies.

Stakeholders further highlighted other factors such as ease of implementation, differing gender perceptions and perspectives, cultural customs and traditions, governance issues, and availability of funds as significant in influencing adoption of management options. One of the main causes of conflicts in the county is a lack of clear administrative and resource borders, which also undermines incentives for managing land resources. One approach to addressing these governance challenges is to strengthen traditional institutions. Some of the government representatives expressed their fear that while funding is likely to persist as a hindrance to implementation of some management options, it is not likely to be solved immediately. While Kenya's devolution structure places much of the key decision-making responsibility and allocation of funds for development under county governments, this system is only in its early stages, and is still facing some teething problems.

Finally, it is important to consider the differences between preferences and perceptions of women and men. In Tana River County, men and women prioritize interventions for ecosystem and natural resource management differently. Unfortunately, in most rural settings in Kenya and across Africa too, decision-making is dominated by men. This is being addressed through policies directed at ensuring more gender-inclusive approaches, but care is still needed to ensure that women's voices are heard.

Stakeholders in Tana River County have a lot of knowledge of the ecosystems within which they live, the services those ecosystems provide, and the interventions and livelihood practices that could protect those ecosystems. They realize the importance of protecting these ecosystem services and have ideas on which interventions will be most effective. Some interventions need more technical expertise, which can often be provided by the county government, but a majority of the approaches identified by respondents are ones that could be implemented with little expertise.

8 Conclusion and implications

Ecosystem services in Tana River County are appreciated by communities living in the area. Respondents ranked the ecosystem services in order from the most to the least valued. This ranking gave highest priority and value to water, land, pasture, forests, wildlife and culture, respectively.

Several management options were also identified under each category of ecosystem service, and a stakeholder preference assessment carried out to ascertain the management options each stakeholder gave importance to. This gave a guide and indicator on gender and livelihood preferences where women and farmers were found to be keen on protecting water and land as ecosystem services, while male pastoralists were focused on land and pasture. Based on the stakeholders' feasibility ranking of each management option, it is likely that the implementing institutions will start with the most feasible options as the challenges facing implementation of the other management options are addressed.

Water and pasture emerged as the most important to the stakeholders. Management strategies proposed to improve water and land as ecosystem resources included grazing management, strengthening of water committees, construction of water harvesting infrastructure, restoration of 'malka' corridors and reseeded.

The scenarios analysis that will be carried out in the next phase of the project will show the impact these targeted management strategies are expected to have on water, land, forage and biodiversity. The interpretation of the scenarios will also assist in decision-making where management options under consideration will be compared to assess which ones use the least financial resources, which ones can achieve results in a short time and are most effective compared to others.

The findings of this report are expected to be used by policymakers in formulation of action plans and policies surrounding ecosystem services management.

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Annex I: Guide for the semi-structured interviews

Enhancing the Value of Ecosystem Services in Pastoral Systems (EVESPS)

Tana River County, Kenya

Nov/Dec 2015

Introduction to the project its purpose and objectives

My name is _____. I am a researcher with the International Livestock Research Institute (ILRI). This work is being carried out collaboratively between the International Union for Conservation of Nature (IUCN).

This study is on the various natural resources and ecosystem services in the county, the importance of each as perceived by administration heads and by the community and also on the difference in opinions of this between men and women. The impact of the various pastoral practices on these services will also be assessed in order to establish management options that can be best implemented to ensure an enhancement of the existing benefits from natural resources in a pastoral system such as this.

With this kind of information, best-bet practices can then be identified and incorporated into the decision-making level in order to minimize the impact that pastoral systems have on the environment and on the ecosystem services. In doing this, the ecosystem services can be enhanced for increased benefits because it is possible for the community to safeguard the ecosystem by sustainable use of the natural resources. Therefore, the management options arrived upon by the implementing agencies can aim at achieving this balance of sustainable use.

This study will also enrich and contribute to the knowledge of pastoral livelihoods and ecosystems in Africa and the interactions existing between human uses and the natural environment.

Methodology: This study will collect information through use of interviews and FGDs.

This interview will take approximately 60–90 minutes and I may use voice recording to capture all details of the interview. I will also be using guide questions but we can discuss further if you feel you have more information that may be useful to the particular question asked.

I will also require your name, age, tribe and information on your means of livelihood. Remember that your participation in this study is completely voluntary and you are allowed to withdraw at any time and for any reason without having to give any explanation. You may also choose not to answer a particular question.

We will provide refreshment and transport at rates arrived upon by the research team.

Confidentiality: All the information gathered in these platforms will remain strictly confidential and only privy to the researchers involved in this EVESPS study and will in no way identify any of the participants present here today.

The results of this study will be reported by means of written publications.

Permission to proceed

If there are any questions or clarifications, please feel free to ask me or interject.

Are there any questions?

If not, may I please begin the interview?

Guide questions

Theme I

Ecosystem services and their value to different stakeholders

1 What are the benefits from natural resources that you know of?

Category by:

- Government/Administration
- NGOs
- Community a) Herders b) Fishermen c) Farmers d) Hunters
- [Ask which natural resources their livelihoods depend on more, is there any way nature is important in your culture, benefits derived from natural resources]
- Gender a) Men b) Women

Some of the expected answers include:

- Water bodies—are source of water for livestock and humans, vegetable production, irrigation, construction purposes, marine habitat
- Forests—for firewood, charcoal production, medicinal, fruits, vegetables/leaves, wildlife habitat, timber production, biodiversity preservation for birds, plants and insects, carbon sequestration, aesthetic purposes, cultural and spiritual purpose, wind breaking, flood control, improved air quality, recreation
- Vegetation—fodder for livestock, food for humans, crop residues for manure, habitat for insects that are nutrient cycling and soil formation, water filtration, sediment control, carbon sequestration
- Land—resting areas, construction spaces, pasture land, mining, habitat for open terrestrial wildlife
- Biodiversity—insects and birds as pollinators, wildlife manure enriching the soils, insects for nutrient cycling and soil formation, source of eco-tourism revenue

2 What efforts have the Government, NGOs and CBOs put towards sensitizing the community regarding the importance of the natural resources and the benefits derived from them?

3 Which of the natural resources benefits do you consider most important or best preferred?

- Government/Administration
- NGOs
- Community a) Herders b) Fishermen c) Farmers d) Hunters
- Gender based preferences a) Men b) Women

Theme 2

Available practices and pastoralist activities—Beneficial and detrimental

1 What are the beneficial practices of the community that promote sustainable use of the natural resources?

2 What are the beneficial practices of the administrative bodies that promote sustainable use of the natural resources?

- Rotational grazing
- Controlled developments
- Land reseeded
- Controlled fishing
- Minimized Human-Wildlife conflicts
- Conservation efforts
- Controlled tree felling
- Re-afforestation
- Erosion control mechanisms

3 What are some of the practices of the community that endanger the ecosystem/ overuse the natural resources?

4 What are the practices administrative bodies participate in that endanger the ecosystem/ over-use the natural resources?

- Deforestation
- Overgrazing
- Bush clearing for farming and cropping
- Urbanization/Construction activities
- Mining
- Overfishing

Theme 3

Existing interventions and ‘on the radar’ management options

5 What management options are in place or are being considered to preserve the integrity of the natural resources? And which of these management options are best preferred or not preferred at all?

NB:

[Once we identify the management options being proposed or already in implementation phase, then we can identify the options that are not on their radar]

- Government/Administration
- NGOs

- Community a) Herders b) Fishermen c) Farmers d) Hunters
- Gender based interventions a) Men b) Women

6 What factors influence implementation of key management options? / What are the challenges being faced or are expected to be faced in the implementation of these management options?

- Government/Administration
- NGOs
- Community a) Herders b) Fishermen c) Farmers d) Hunters
- Gender based challenges a) Men b) Women

7 What in your opinion are the most promising and cost effective interventions?

NB

[This will help answer the most feasible management options both politically and institutionally]

- Government/Administration
- NGOs
- Community a) Herders b) Fishermen c) Farmers d) Hunters
- Gender based opinions a) Men b) Women

8 How are you able to ascertain that the interventions selected are the better choices?

- Government/Administration
- NGOs
- Community a) Herders b) Fishermen c) Farmers d) Hunters
- Gender based opinions a) Men b) Women

9 What are the expected benefits that will arise from the various interventions?

Government/Administration

- NGOs
- Community a) Herders b) Fishermen c) Farmers d) Hunters
- Gender based opinions a) Men b) Women

Thank you for your participation.

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