



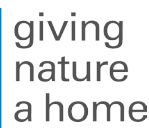
# Land Use Plan for the **TANA RIVER DELTA**



# Tana River Delta

## LAND USE PLAN

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Learning and collaboration for people and biodiversity



**Authors:**

Peter Odhengo, Paul Matiku, Patrick Waweru, Dan Guda, Tom Kinara, Sammy Kathike, Eugene Mmyamwezi, Serah Munguti, and George Koyier

**Edited by:**

Serah Munguti, Caroline Kabilu, Fleur Ng'weno, John Nyangena, Peter Nelson, John Mwacharo, Peter Odhengo and Paul Matiku

**Design and Layout:**

John Mwacharo

**Lead institutions:**

Governments of Tana River and Lamu Counties, Ministry of Land, Housing and Urban Development, The National Treasury and Nature Kenya

**Collaborating Institutions:**

Ministry of Environment, Water and Natural Resources; Ministry of Agriculture, Livestock and Fisheries; Ministry of Information, Communication and Technology; Ministry of Planning and Devolution; Ministry of Land, Housing and Urban Development; The National Treasury; Ministry of Interior and Coordination of National Government; Government Agencies: Kenya Forest Service, National Environment Management Authority, Kenya Institute for Public Policy Research and Analysis; National Museums of Kenya, Tana and Athi Rivers Development Authority, Imarisha Naivasha Board; and Civil Society: Nature Kenya - The East Africa Natural History Society; the Royal Society for the Protection of Birds and the World Wide Fund for Nature.

**Technical Advisor:**

Peter Nelson

**GIS Expert:**

Dickens Odeny

**Technical Advisor:**

Netherlands Commission for Environmental Assessment

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**Tana River County**

P.O. Box 29-70101 GPO, Hola, Kenya  
info@tanariver.go.ke  
www.tanariver.go.ke

**Lamu County**

P.O Box 74 – 80500, Lamu  
info@lamu.go.ke  
www.lamu.go.ke

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**Members of the Inter-Ministerial Technical Committee on Sustainable Management of  
Deltas in Kenya**

<b>NO.</b>	<b>NAME</b>	<b>ORGANIZATION</b>
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15.	Brian Waswala	Kenya Wildlife Service
16.	Daniel M. Mbithi	Kenya Forest Service
17.	Ernest Mwongela	Nature Kenya
18.	Serah Munguti	Nature Kenya
19.	Zephania O. Ouma	National Environment Management Authority
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33.	Dickens Odeny	National Museums of Kenya
34.	Benjamin Tuikong	Ministry of Information, Communication and Technology
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36.	Patrick Oloo	Ministry of Environment, Water and Natural Resources
37.	David Gitonga	Ministry of East Africa Affairs, Commerce, and Tourism
38.	Tom Kinara	Ministry of Agriculture, Livestock and Fisheries



### Members of the Tana Planning Advisory Committee (TPAC)

NO.	NAME	ORGANIZATION
1.	Omar W. Buketa	Tana River County Executive for Lands, Agriculture, Livestock and Fisheries
2.	Amina Rashid Masoud	Lamu County Executive for Land, Physical Planning, Infrastructure Urban Development, Water and Natural Resources
3.	Sophia O. Wedo	Tana River County Executive for Environment, Natural Resources and Wildlife
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5.	Salim Mohamed	Tana River County Executive for Water, Health and Sanitation
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7.	Ali K. Ahmed	District Development Officer – Tana Delta
8.	Paul Njau	District Development Officer - Lamu
9.	Judy Hamasa	Agriculture Extension Officer, Tana Delta
10.	Maurice Ochieng	Physical Planning Officer, Tana River
11.	Maurice Ogoma	Fisheries Officer, Lamu
12.	Dominic Mumbu	Nature Kenya
13.	Peter Munywoki	District Livestock Production Officer's Office – Tana Delta
14.	Swaleh Wario	Orma Council of Elders
15.	Hassan Barisa	Wardei Council of Elders
16.	Dabane SoSo	Watha Council of Elders
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18.	Said Botaya	Farmers' representative
19.	Moses Jaoko	Beach Management Unit – Freshwater
20.	Hadija Bante	Beach Management Unit - Marine
21.	Ijema Godana	District Peace Committee
22.	Said Nyara	Conservation Groups representative
23.	Margaret Hiribae	Maendeleo ya Wanawake Chair- Tana Delta
24.	Mary Kaingu	Maendeleo ya Wanawake - Kipini
25.	Zainab Golo	District Livestock Marketing Council
26.	Abdalla Bakero	Ranchers Forum
27.	Ayub Israel	People with Disabilities representative
28.	Aladdin Malibe	Youth Representative
29.	Mohamed Bworu	Business Community representative
30.	Ustadh Abdulahi Hajj Gudo	Council of Imam Preachers in Kenya ; CDF Chairman Garsen Constituency
31.	Bishop Douglas Machafu	National Council of Churches in Kenya
32.	Maurice Karisa	Maridhiano CBO
33.	Stanley Robert	Member of Parliament's Office, Garsen Constituency
34.	Yahya Ali	Member of Parliament's Office, Garsen Constituency
35.	Mohamed Roba	Senator's Office, Tana River County
36.	Abdulkadir Rashid Mohammed	Senator's Office, Tana River County

### Members of the Tana Planning Advisory Committee (TPAC)

NO.	NAME	ORGANIZATION
37.	Lennox C. Mbwana	Planning Office, Tana River County
38.	Hassan Roble	District Peace Committee
39.	Juma M. Mohammed	Agricultural Sector Development Office
40.	Odera George	Nature Kenya, Tana Delta Office
41.	Natasha J. Dulu	Maendeleo ya Wanawake, Tana Delta
42.	Fredrick Aloo	Medium Term ASAL Programme (MTAP/NRM) Tana River County
43.	Nimrod Imani	National Council of Churches in Kenya
44.	Ali Jillo	National Security Intelligence Service, Tana Delta
45.	Evans Juma	Subcounty Livestock Production and Development Officer, Tana Delta
46.	Lilian Mudia	Youth representative
47.	Andrew Waweru	Subcounty Planning and Development Officer, Lamu
48.	Matthew Bwaboya	Subcounty Planning and Development Officer, Tana River
49.	Vincent Osewe	Physical Planner, Lamu
50.	Jilo Kokani	Tana Delta Conservation Network
51.	Mohamed B. Athman	Agricultural Extension Officer, Tana Delta
52.	Dr. Ong'are D.O.	Subcounty Veterinary Officer, Tana Delta
53.	Hiribae Tufani	Subcounty Planning and Development Officer, Tana Delta
54.	Dara Ali Abubakar	WAYPRI CBO
55.	Hussein O. Goricha	Personal Assistant, Garsen Central Ward
56.	Robinson Thuku	Officer in Charge of Police Division, Tana Delta
57.	Boaz M. Shiramba	Agricultural Sector Development Support Programme, Tana River County
58.	Abaroba Barisa	Office of the Governor, Tana River County
59.	Kahindi Yeri	National Environment Management Authority, Tana River County
60.	Hassan Roble	Peace Committee representative
61.	Salat Dakau	Member of County Assembly, Tana River
62.	Hadija Guya	Women representative, Tana River County
63.	Wilson Abashuba	Golbanti Farmers Association
64.	Hope Mwanyuma	National Environment Management Authority, Tana River County
65.	Mohammed Roble	Businessman
66.	Rashid A. Were	Assistant Deputy County Commissioner
67.	Hussein Gobu Godana	Member of County Assembly, Tana River

## UNITS OF MEASUREMENT

<b>Ha</b>	One Hectare (10,000 square metres)
<b>Km<sup>2</sup></b>	One hundred hectares
<b>M<sup>3</sup>/sec</b>	Cubic metre per second (measurement of river flow)

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## LIST OF ACRONYMS

<b>AECF</b>	Africa Enterprise Challenge Fund	<b>LTDCT</b>	Lower Tana Delta Conservation Trust
<b>AEWA</b>	Africa-Eurasian Water Bird agreement	<b>LUP</b>	Land Use Plan
<b>ASAL</b>	Arid and Semi-Arid Lands	<b>MCA</b>	Member of County Assembly
<b>CDA</b>	Coast Development Authority	<b>MDG</b>	Millennium Development Goal
<b>CFA</b>	Community Forestry Association	<b>MEA</b>	Multilateral Environmental Agreement
<b>CITES</b>	The Convention on International Trade in Endangered Species	<b>NCCAP</b>	National Climate Change Action Plan
<b>CLB</b>	Community Land Board	<b>NCCRS</b>	National Climate Change Response Strategy
<b>CMS</b>	Catchment Management Strategy	<b>NEMA</b>	National Environmental Management Agency
<b>CPDC</b>	County Planning Development Committee	<b>NMK</b>	National Museums of Kenya
<b>DAO</b>	District Agriculture Office	<b>MP</b>	Member of Parliament
<b>DLD</b>	District Land Board	<b>NLC</b>	National Land Commission
<b>DRSRS</b>	Department for Resource Surveys and Remote Sensing	<b>NTFP</b>	Non Timber Forest Product
<b>EBA</b>	Ecosystem Based Management	<b>NRT</b>	Northern Rangeland Trust
<b>EIA</b>	Environmental Impact Statement	<b>PGF</b>	Planning Green futures
<b>FAO</b>	Food and Agriculture Organization	<b>PPP</b>	Public-Private Partnership
<b>FTE</b>	Full time employment equivalent	<b>TARDA</b>	Tana and Athi Rivers Development Authority
<b>GIS</b>	Geographic Information System	<b>TLU</b>	Tropical Livestock Unit
<b>GPS</b>	Global Positioning by Satellite	<b>TPAC</b>	Tana Planning Advisory Committee
<b>HGFD</b>	High Grand Falls Dam		Ramsar International Wetland designated under the Convention signed in Ramsar
<b>IBA</b>	Important Bird Area	<b>REDD</b>	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
<b>ICZM</b>	Integrated Coastal Zone Management	<b>RSPB</b>	The Royal Society for Protection of Birds
<b>IGAD</b>	Inter-Governmental Authority on Development	<b>SEA</b>	Strategic Environmental Assessment
<b>IMF</b>	International Monetary Fund	<b>UNFCCC</b>	The United Nations Framework Convention on Climate Change
<b>IMTC</b>	Inter-ministerial Technical Committee on the Sustainable Management of Deltas in Kenya	<b>WIO</b>	Western Indian Ocean
<b>ISIC</b>	International Standard Industrial Classification	<b>WRMA</b>	Water Resources Management Authority
<b>IUCN</b>	International Union for Conservation of Nature	<b>WRUA</b>	Water Resource Users Association
<b>KBA</b>	Key Biodiversity Area	<b>Vision 2030</b>	Kenya Economic Development Plan
<b>KEFRI</b>	Kenya Forestry Research Institute		
<b>Kengen</b>	Kenya Electricity Generating Company		
<b>KWS</b>	Kenya Wildlife Service		
<b>LAPSSET</b>	Lamu Port South Sudan Ethiopia Transport Corridor		



## MESSAGES FROM TANA RIVER COUNTY GOVERNOR

**A** better future for the people of Tana River County will be ushered in by this Land Use Plan.

The Tana River Delta, a vast seasonal wetland at the southern tip of Tana River County, is important locally, nationally and internationally. It absorbs the floodwaters of eastern Kenya, protects the shore from erosion, sequesters carbon dioxide and supports local communities and diverse wildlife. The Delta is a source of livelihood for pastoralists by providing dry season grazing areas; for farmers who rely on its soil and water for their agricultural activities; and for fisher folk and other communities that derive their livelihoods from the Delta. Thus the Tana River Delta has been a blessing to the local inhabitants.

However, events of the past few years have shown that this Delta, that has been a lifeline for local communities for centuries, is under great threat. The recent conflicts between pastoralists and farmers was attributed, after an in-depth inquiry by a commission of inquiry set up by the Government of Kenya, in part to competition for the natural resources within the Delta. These resource use conflicts are driven by an increasing population, not just from high birth rates but also from the high influx of people from other areas seeking land and a new life. Since the Tana Delta population is expected to continue on an upward trend while the resources remain unchanged, these conflicts would be expected to escalate, especially when no decisive steps are taken to reverse the trends.

This Land Use Plan, therefore, comes at an opportune time, when the Tana River County Government tries to restore order, promote harmony among the various communities that reside in the Delta and ensure quality service delivery. The land use plan will be used by the County Government to regulate the use of the Delta's resources; to make sure these resources are used wisely to support the sustainability of the various livelihood options pursued by the communities; to promote security, equity



**H.E Hussein Dado**  
**Governor, Tana River County**

## MESSAGE FROM LAMU COUNTY GOVERNOR

**L**and use planning is a critical and integral part of sustainable development.

In the past, lack of proper land use plans or poorly designed and developed plans have led to serious conflicts. The County Government of Lamu is proud to be part of the Tana Delta land Use Planning Process that has culminated to this Land Use Plan



**H.E Issa A. Timamy**  
**Governor, Lamu County**

Although only a small section of the Tana Delta lies within Lamu County, that portion is vital, as it affects life both within and beyond the Delta. Proper planning and management of the Delta is therefore critical for the County Government of Lamu. The Tana Delta provides life support to the farmers, fisherfolk and pastoralists who reside within it. The Delta is also important for recharging the aquifers that lie beyond the Delta's boundary.

In the recent past, conflicts have been increasing in the Tana River Delta. These conflicts have led to a general sense of insecurity and a lack of trust among the local inhabitants, a factor that constrains service delivery by the County Government and others. These challenges may escalate with the major infrastructural developments expected in Lamu such as the Lamu Port South Sudan Ethiopia Transport Corridor (LAPSSET) projects and especially the development of the open port which is expected to attract a much larger population as people will move in to take advantage of the various trade and business opportunities that will come with these investments. Such anticipated population growth alone warrants the development of proper land use plans.


I am confident that effective implementation of the proposals made in this land use plan will help us as a County Government to address some of the challenges that have been difficult to deal with in the past, especially owing to a lack of factual information now presented in both the Land Use Plan and the Tana Delta Strategic Environmental Assessment.



and effective service delivery; and to ensure that biodiversity remains part of the heritage of the local people. Tana Delta has delicate flora and fauna that is unique to the area.

As the Governor of Tana River County, I take this opportunity again to thank the various actors who have worked tirelessly to make the process a success. The Tana River County Government has been committed throughout this process and will remain so during the implementation of this plan. We shall endeavour to integrate the proposals made here in our County's Integrated Development Plan (CIDP). We shall also ensure that where possible, governance structures are put in place with the participation of the local communities to ensure its implementation, especially where issues of access, use and benefit sharing are concerned. We shall also partner with all stakeholders, both government and non-governmental organizations, during the implementation of this land use plan with a view to effectively serve the people of Tana River County.

Lastly, the Tana River County Government will see that this land use plan and the recommendations made by its attendant Strategic Environmental Assessment are used by present and future planners, educators, environmentalists, developers, decision makers and other interested parties in all matters relating to the access and use of the Tana River Delta, with the goal of actualizing the inter-linkages between environmental sustainability, human livelihoods and development.



**H.E. Amb. Hussein Dado**  
**Governor, Tana River County**

Information contained in the land use plan will guide the County Government in policy formulation and decision making, especially with regard to future development; guide future land allocations to different users; and provide a first step towards restoring peace, harmony and trust among the local communities. All these are a prerequisite for effective development. The effective implementation of this land use plan will enable the County Government and local communities to realize sustainable development.



**H.E. Issa Timamy**  
**Governor, Lamu County**

## FOREWORD

The Tana River Delta Strategic Environmental Assessment (SEA) was prepared to support the land use planning process for the Area. The SEA is a result of extensive consultation at community, county and national level with the input of international SEA experts.

The core area of the Tana River Delta comprises land within Tana River and Lamu Counties. The Tana River Delta is a vast patchwork of palm savanna, seasonally flooded grassland, forest fragments, lakes, marine wetlands and the river itself. This combination of habitats makes the Tana Delta a biodiversity hotspot. It is designated as a Ramsar site – a wetland of international importance – and an Important Bird and Biodiversity Area.

The Delta is sparsely populated and inhabited by three major communities comprising Pokomo farmers, Orma pastoralists and Wardei pastoralists. Other ethnic groups include the Bajuni, Luo, Luhya, Boni, Wataa/Sanye, Malakote and Munyoyaya, among others. Large and small scale irrigation farming takes place in the Tana Delta. Large herds of cattle graze in the Delta during the dry season. In addition, a number of projects within Kenya's Vision 2030 are planned within the Delta and its catchment.

Over the past decade, conflicts have been increasing in the Tana River Delta as a result of increasing population, competition for land, land-based resources and access to water, and encroachment into fragile ecosystems. These conflicts are compounded by lack of a general framework to guide decision-making on development of the Delta. This has compromised natural resource conservation efforts and community interests. The challenges facing the Delta require a coordinated approach to planning and management of the resources in the Delta. Only land use planning can provide that opportunity, as sectoral planning tends to be single-resource focused.

Preparation of a Land Use Plan for Tana River Delta to guide policy formulation and decision-making on future development of the Delta started in September 2011 through the Ministry of Lands and with involvement of other agencies. It is part of a programme to coordinate the sustainable management of Deltas in Kenya, initiated in July 2011 by the Office of the Prime Minister with an Inter-Ministerial Technical Committee composed of 18 ministries. This SEA was conducted concurrently with the Tana River Delta land use planning process. The SEA in particular seeks to strengthen the integration of socio-economic and ecological aspects in the Tana Delta Land Use Plan. These include:

- i. Describing the external and in-situ factors influencing land use in the Tana River Delta;
- ii. Ensuring integration of stakeholders' socio-economic and environmental perspectives into the proposed LUP;
- iii. Establishing the implications of the proposed LUP on Tana River Delta sustainable management and development;
- iv. Identifying and mapping out specific habitats, natural resources or land use zones that should be preserved in perpetuity to ensure the survival of the Tana River Delta ecosystem;
- v. Assessing alternative land use options that can inform the preferred strategy and plan.

In particular the analyses within this SEA were instrumental for the interrogation of development of land use options in the Tana Delta and the development of the preferred land use strategy that strikes the best balance between development and conservation.

The Tana River Delta SEA is based on the Organisation for Economic Cooperation and Development Assistance Committee (OECD-DAC) SEA framework on which Kenya's SEA Guidelines are largely based, and the World Bank approach to Institutional SEA in which attention is given to institutional strengths and weaknesses and the capacity of institutions to implement decisions.

## ACKNOWLEDGEMENT

The Tana River Delta Land Use Plan (LUP) was formulated by the Inter-ministerial Technical Committee (IMTC) on the Sustainable Management of Deltas in Kenya. The technical production of the Tana Delta LUP was undertaken by the LUP Team, coordinated by Peter Odhengo initially from the Office of the Prime Minister and later from the National Treasury. The LUP team comprised representatives from various public and private organizations: Peter Odhengo (National Treasury), Paul Matiku (Nature Kenya), Patrick Waweru (Ministry of Land, Housing and Urban Development), Dan Guda (Ministry of Agriculture, Livestock and Fisheries ), Sammy Kathike (Ministry of Land, Housing and Urban Development), Tom Kinara (Ministry of Agriculture, Livestock and Fisheries), Eugene Mmyamwezi (Ministry of Environment, Water and Natural Resources), Serah Munguti (Nature Kenya), George Koyier (Ministry of Environment, Water and Natural Resources) and Dickens Odeny (National Museums of Kenya). The LUP team was responsible for compiling this report.

The Tana Planning Advisory Committee (TPAC), composed of representatives of key stakeholders at the community and county level, was instrumental in providing information for this report as well as in creating awareness among the communities by organizing and participating in village consultations.

Peter Nelson of Planning Green Futures (PGF) provided international expertise throughout the process. Helen Byron of Royal Society for Protection of Birds (RSPB) in United Kingdom provided technical and supervisory support to the International Expert and reviewed the LUP. Sarah Sanders of RSPB provided overall coordination and link with the UKaid who provided invaluable financial support. To all these we would like to express our deep appreciation.

We are highly indebted and grateful to Nature Kenya for mobilizing funding from UKaid, the Royal Society for the Protection of Birds, US Fish and Wildlife Service, Ecosystem Alliance (IUCN Netherlands, Wetlands International and Both ENDS) and the World Bank to support this activity, providing logistical support, and availing personnel at the local level during community consultations.

Sincere thanks go to the Governments of the Tana River and Lamu Counties, the National Government of Kenya through Ministries, Agencies and non government institutions which provided technical staff to the IMTC: Ministry of Environment, Water and Natural Resources; Ministry of Agriculture, Livestock and Fisheries; Ministry of Information, Communication and Technology; Ministry of Planning and Devolution; Ministry of Land, Housing and Urban Development; The National Treasury; Ministry of Interior and Coordination of National Government; Government Agencies: Kenya Forest Service, National Environment Management Authority, Kenya Institute for Public Policy Research and Analysis; National Museums of Kenya, Tana and Athi Rivers Development Authority, Imarisha Naivasha Board; and Civil Society: Nature Kenya - The East Africa Natural History Society; the Royal Society for the Protection of Birds and the World Wide Fund for Nature.

Peter O. Odhengo  
Deltas Secretariat Team Leader

## PREFACE

Kenya's Tana River Delta is a vast seasonal wetland complex. Its importance locally, nationally and internationally is well documented. The Delta is a home and source of livelihoods to pastoralists, farmers and fishermen, and a dry season grazing area for pastoralists from within and outside the Delta. Large and small scale irrigation farming takes place in the Tana Delta and the River Tana catchment. Extensive scientific research on the flora and fauna in the Tana Delta has been done by local and foreign researchers. The Delta is rich in flora and fauna and is designated as a Ramsar site – a wetland of international importance – and an Important Bird and Biodiversity Area.

The Tana River Delta Land Use Plan comes at an opportune time, when devolved government is in place to tackle local challenges. The Land Use Plan addresses issues that in the past have led to resource use conflicts between farmers and pastoralists in the Delta, most recently in 2012-13. The Commission of Enquiry on Tana River clashes was constituted in September 2012 and among its findings was that conflict over water and land resources was partly responsible for the violence.

Given the social and economic sensitivities in the Tana River Delta this Land Use Plan has been subjected to a Strategic Environmental Assessment (SEA). It is the first time in Kenya and in Africa that a Land Use Plan is informed by a SEA, with the two processes running concurrently. The growing human population and competition for diminishing natural resources, compounded by the effects of climate change, have necessitated a drastic change in the way we do things.

The Tana River Delta Land Use Plan is a collaborative effort of various stakeholders at national, local and international levels. It is the most comprehensive milestone so far in the preparation of policy that will contribute to sustainable development of the Delta. The Land Use Plan is informed by in-depth analyses of existing social economic and environmental conditions in the Delta, and reviews the policies and initiatives that bear on the Delta and the River Tana catchment. Its recommendations are based on scenario building informed by extensive analyses. It includes maps, diagrams, graphics and tables on social, environmental, economic conditions and political set up.

This Land Use Plan promotes regulated access, wise use and improved rangeland management that will lead to improved sustainable livelihoods, security, equity and biodiversity conservation. Agricultural intensification will take into account Integrated Multiple Land Use Plan, Strategic Environment Assessment (SEA), indigenous food and livestock systems and enhance agricultural, rangeland and pastoral systems within a framework of increased vegetal cover and fresh water quality enhancing sustained flow of ecosystem services including biodiversity.

Implementation of this Land Use Plan will ensure that current forest cover, water quality, quantity and quality of biodiversity are maintained through a system of gazettelement as provisional forests or community conservation areas that are supported by regulatory frameworks and management plans implemented by government, private sector and local people committed to wise use of the Tana Delta natural resources for posterity.

The Tana River Delta Land Use Plan is a framework to support government, private sector and small holder developments that are guided by Strategic Environment Assessment (SEA), management plans and operational standards and have capacity to ensure continued wise use of Tana Delta's natural resources and flow of ecosystem services.

The effective implementation of this Land Use Plan calls for capacitated institutions to drive policy change to redress the balance of rights, responsibilities and benefits of sustainable land management and conservation more equitably between the government, communities and the private sector. This enhanced institutional capacity will lead to:

1. County governments that have mainstreamed Sustainable Land Management into county development plans
2. County and community level governance and regulatory structures that guide access, use and benefit sharing and ensure the use and access is equitable to present and future generations.
3. Local institutions and private sector that understand and are able to implement sustainable land management practices and regulations.
4. Strategic Environmental Assessment and Land Use Plan accepted by all stakeholders as the basis for guided development in Kenya.

The Tana River Delta Land Use Plan hinges on the Constitution of Kenya, 2010, among other laws. It also borrows

from international best practice. In the past, most of land use planning in Kenya was undertaken for towns and urban centers. In this respect this Land Use Plan is a first step in a ground breaking process in that will introduce sweeping changes in the way land is managed in Kenya.

Preparation of the Land Use Plan for Tana River Delta to guide policy formulation and decision-making on future development of the Delta started in September 2011 through the Ministry of Lands and with involvement of other agencies. It is part of a programme to coordinate the sustainable management of deltas in Kenya, initiated in July 2011 by the Office of the Prime Minister with an Inter-Ministerial Technical Committee composed of 18 ministries. The Land Use Plan will significantly influence the way land is allocated to various users and interest groups.

The Tana Delta Land Use Plan finds that many of the elements of sustainable pathways to development exist or can be readily realized. What is needed is a systematic framework, a leadership consensus and political will. Peace in Tana Delta is dependent on a holistic policy response to the use and development of Delta land resources. This Land Use Plan provides vital information to guide formulation of such policy response.

# **PART ONE**

## CORE DOCUMENT



# THE ROLE OF THE TANA DELTA LAND USE PLAN

## 1.1 Introduction

The Tana River Delta Land Use Plan (LUP) constitutes a negotiated and agreed policy document to guide future development in the Tana Delta. The entire document confirms the policies and approach of the Governments of the Tana River and Lamu Counties and the National Government. The LUP provides direction towards a desired future for the Delta, its people and resources, and seeks to facilitate consistent and predictable decision making on future development issues. The plan aims to guide public and private investments and contribute to reduced tensions and conflict over land and water resources. It can achieve these objectives because it is based on sound science and extensive consultation with local people.

The LUP provides a description of the key issues facing the Tana River Delta and describes its character and national and international importance. It explains how national policies help to determine the area's future and identifies specific zones within which local plans, policies or 'statements of intent' will determine appropriate land uses. This Land Use Plan sets out the criteria by which future development proposals will be judged and designates areas where development will be permitted and other areas where the types and scale of developments will be restricted. In addition the plan provides regulations to guide resource management and to integrate other planning and management processes such as Environmental Impact Assessment procedures. As such, this Land Use Plan is the overarching planning document for the Tana River Delta.

## 1.2 Developing the Content of the Draft Plan

The Draft Plan has been produced in accordance with a Land Use Planning Framework published by the Ministry of Lands and the former Office of the Prime Minister in 2012. Full details of the methodology and content of the LUP Framework are set out in Part 2 of this document.

## 1.3 Status of the Tana Delta Draft Land Use Plan

This plan has been prepared using the combined resources of the National and District (now County) administrations. Because the plan covers parts of two counties it has the status of a Regional Physical Development Plan (see Part IV, Physical Planning Act,

Revised 2012). It also satisfies the requirements for the relevant parts of Tana County and Lamu County in terms of the preparation of County Spatial Plans (under section 110 of the County Governments Act, 2012).

## 1.4 Consultation on the Draft Plan

This Plan is published in June 2015 as a basis for further review and implementation, the details of which will be determined by joint working groups of the two County governments and the National Government.

## 1.5 SEA Preparation Process

In its first meeting on 19 July 2011, using its convening power the Office of the Prime Minister (OPM) formed an Inter-Ministerial Technical Committee (IMTC) made up of twenty two relevant government ministries and agencies . This was followed by the formation of a core team comprising of 11 members from OPM, NEMA, Kenya Wildlife Service (KWS), Kenya Forest Service (KFS), Ministry State for Planning, National Development and Vision 2030 (MPND & V2030), Ministry of Lands (MOL), Ministry of Agriculture (MOA), Ministry of Water and Irrigation (MOW&I), Nature Kenya (NK) and IMARISHA Naivasha Board.

From 24<sup>th</sup>–26<sup>th</sup> July 2011, the core team of the IMTC developed a strategic framework to oversee planning for deltas in Kenya starting with the Tana River Delta. The overall purpose of the strategy is to provide a roadmap and governance structures that would guide the Kenyan Deltas initiative to undertake General Management Planning that use participatory approaches to identify actions, define strategies, timelines and milestones to achieve sustainable development framework for Kenya's deltas .

### 1.5.1 Launch of the Tana Delta Planning Process

In September 2011, the IMTC convened a high level meeting in Malindi to inform local stakeholders and discuss the need for a strategic plan for the Tana River Delta. Sixty five (65) participants took part in the meeting. The meeting was hosted by OPM, while NEMA and Nature Kenya provided joint Secretariat.

Representatives from key Kenyan government ministries and agencies attended together with local community representatives, NGOs, media and international experts in the fields of land use and delta planning and SEA. The meeting included a workshop and a field visit into the

Tana River Delta to provide an opportunity to interact and consult with the local people to understand the issues first hand.

The meeting concluded by adopting a Communiqué which confirmed the launch of the Tana Delta planning initiative. This noted that the aim of the initiative is to produce a long-term strategic land use plan representing a 'truly sustainable' future to the delta, informed by Strategic Environmental Assessment and that the process would take place over the next 18 months, with the support of Department for International Development - United Kingdom Aid (DFID-UKAid).

In a follow up meeting on 27<sup>th</sup> September 2011 the IMTC agreed that Ministries of Lands, Planning, Environment and OPM should second officers to the secretariat in order to support an international consultant in developing the SEA and LUP process for the Tana Delta. An officer from the Ministry of Lands would lead a Land use planning (LUP) team, while one from MPND & V2030 would lead the SEA team. The two teams would comprise technical officers working on the Tana Delta LUP and SEA, and be advised by an international consultant and the Netherlands Commission for Environmental Assessment

OPM provided office space and furniture for the secretariat, while Nature Kenya equipped the office with computers, a printer and other basic office equipment. The international expert provided technical advice to the Secretariat. A manual on Tana LUP and SEA was developed and the terms of reference for the secretariat agreed upon.

During the IMTC site visit in September 2011, the Tana Delta site based Planning Advisory Committee (TPAC) was constituted. The TPAC was made up of 21 members of which 19 represent local community interests including pastoralists, fisher folk, farmers, women groups, development oriented CBOs, conservation groups, marine fishermen, people with disabilities, among others. Four key government agencies made up the other 4 PAC members and included the District Development Officer, District Livestock Officer, District Agriculture Officer and District Commissioner. The March 2013 general elections ushered in a new devolved governance system centered on counties. Consequently the TPAC became greatly expanded (to a membership of 67) to accommodate county government interests. The PAC is convened under the authority of a chair appointed by the County Governments and each meeting is chaired by a TPAC member selected on rotation. The role of the committee is to provide advice and feedback on the content of the LUP and SEA based on papers to be presented to it. In this respect, the TPAC mirrors the work of the IMTC at national level within the Delta.

### **1.5.2 Stakeholder consultations**

At the launch of the Tana Delta planning process in September 2011, the IMTC held launch event meetings at District level (Gamba Guest House) and local launch events at Moa, Dide Waride and Tarasaa.

From 1<sup>st</sup>-3<sup>rd</sup> February 2012, the IMTC launched the LUP for Tana Delta at divisional level (Kipini, Garsen and Tarasaa) followed by village level meetings at Gatundu, Moa and Ozi. In March – June 2012 Nature Kenya staff in Tana Delta and District Livestock Production Officer, District Agricultural Officer and District Development Officer conducted meetings in all the 106 villages in the Delta to facilitate community members to provide input via a questionnaire that was developed and reviewed by the LUP and SEA teams. The outcomes of village land use planning meetings included development of initial Village LUP maps, which fed into the LUP process and will further inform its implementation.

In March 2012, the SEA working group held meetings in Kipini, Danisa, Kibusu, Moa, Dide Waride to collect data on issues affecting the communities in Tana Delta for planning purposes. The SEA secretariat held discussions with the county councils of Tana River and Lamu, both recognized as important players in the Tana Delta. This helped clarify the purpose of the entire process and defuse any suspicion. The Water Resources Management Authority, Tana catchment Regional Office, was also visited and important information obtained that informed the SEA. It however emerged that the Water Resource Users Associations (WRUAs) were yet to be established in the lower delta.

### **1.5.3 Independent Review**

In November 2011, NEMA requested the Netherlands Commission for Environmental Assessment to advise on the Strategic Environmental Assessment of the Land Use Plan, for the Tana Delta in Kenya. The Commission and NEMA agreed to apply a two-step approach: firstly the Commission would advise before the start of the LUP/SEA on the overall process and approach of the LUP/SEA. Secondly, the Commission would provide advice on (i) the process, more detailed based upon field observations and discussions with members of the LUP and SEA team and (ii) on the contents of the SEA and the Land use plan. Copies of the Commission's comments were made available through the Deltas Secretariat and published on the Commission's website. On both occasions advice received guided the focus and SEA/LUP process on methodology and on the need to centre the LUP on water availability in the catchment. Nature Kenya, the international consultant and the Deltas Secretariat responded to the Commission's advice. The Commission has also agreed to review the draft final LUP and SEA on completion of these two documents.

# CHAPTER 2

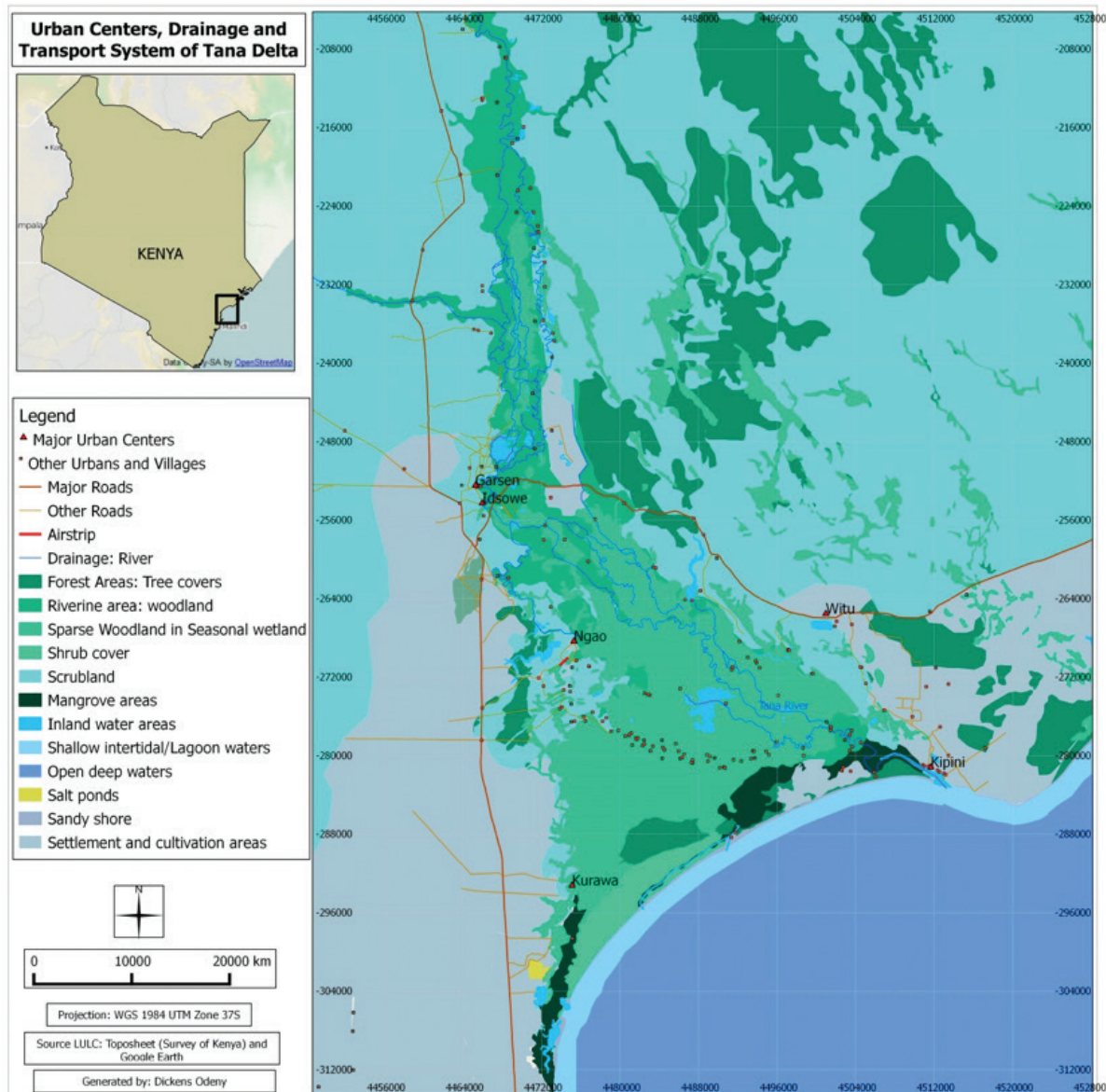
## KEY PLANNING ISSUES

### 2.1 Introduction

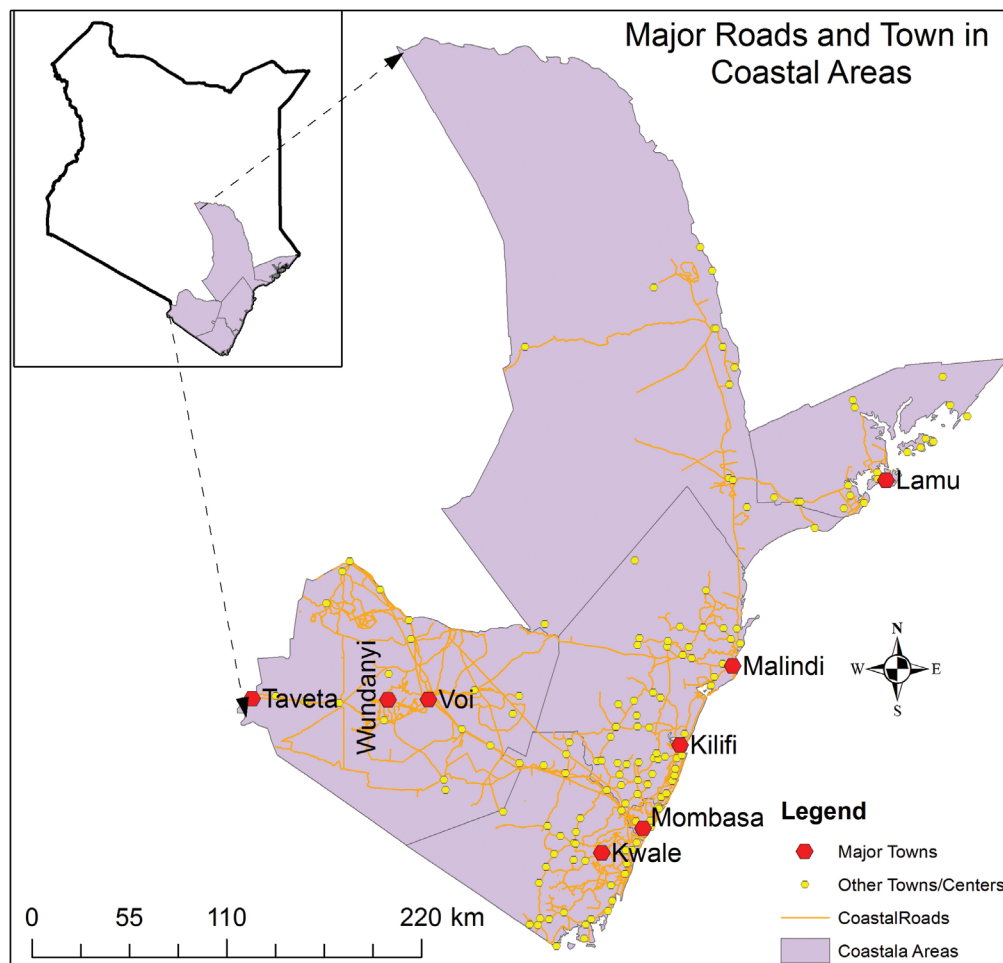
The River Tana is over 700 kilometres long and is Kenya's longest river. It rises in Mount Kenya and the Aberdare mountain range in central Kenya, meandering to the Tana Delta, a vast floodplain ecosystem that is highly rich in wildlife (Maingi and Marsh, 2002). The Delta is a rich mosaic of palm savannah, seasonally flooded grassland, swamps, riverine forest fragments, lakes, woodland, mangroves, sand dunes, beaches and the river itself. The Delta provides refuge for over 350 species of birds, including the globally threatened Basra Reed Warbler

(Bennun and Njoroge, 1999). It is also home to two endemic and endangered primates, the Tana River Red Colobus monkey and the Tana River Crested Mangabey, as well as providing an important wildlife dispersal area for hippopotamus, crocodiles, elephants and other big game from Tsavo National Park (Bennun and Njoroge, 1999). An area of 2250 km<sup>2</sup> encompasses the Delta and forms the core of the Plan, although this is surrounded by a buffer zone 20 kilometres wide which covers a further 4020 Km<sup>2</sup>.

**Figure 2.1 Urban Centers, Drainage and Transport System of Tana Delta**



**Figure 2.2 Major Roads and Towns in the Kenyan Coastal Area**



The Delta provides essential ecosystem services to 102,000 people living in the Plan Area including pastoralists who depend on the water and grasslands for their livestock during the dry season, the agriculturalists who cultivate rice and other crops on the receding floodplain edges and the fishermen from several ethnic groups who fish from its lakes and watercourses (Odhengo *et al*, 2014a). When this vast wetland is left undisturbed, it acts like a sponge, absorbing floods, storing water and remaining green during the dry season. The thick vegetation also absorbs carbon dioxide gas from the air (Kitheka *et al*, 2002).

Even small changes to the hydrological system can upset the natural balance of a delta. This needs to be very carefully assessed in all situations. This Plan is based on a thorough assessment of the relevant issues for Tana Delta and sets out a blueprint for ensuring that the long-term future of the Tana Delta is enhanced.

The ambitious national economic development plan, dubbed Vision 2030, produced by the former administration, pinpointed the River Tana Basin as

a priority site for agricultural expansion, without testing the viability of the underlying concepts in terms of their local social, environmental or economic effects. Consequently, the Tana Delta is under serious consideration for a range of development projects, including oil seed farming, massive sugar cane plantations, biofuel farms, exploration for oil and gas, and titanium extraction. All of these could threaten the integrity of the delta ecosystem.

Unless guided by a planning framework based on Strategic Environmental Assessment (SEA), the responses to competing human, wildlife and economic interests are likely to be largely short-term. Poverty and inequality remains high in Kenya – in Tana Delta 73% of people still live below the poverty line (Odhengo *et al*, 2014a). The Tana Delta has potential both to better meet the needs of its inhabitants and contribute to the national economy.

## 2.2 Major Issues

The SEA undertaken to inform this Land Use Plan has highlighted major issues which need to be addressed if



the long-term future of the Tana Delta and its people is to be assured. Each of these issues is summarised below. The SEA is published as a separate report which accompanies this Land Use Plan (Odhengo *et al*, 2014a).

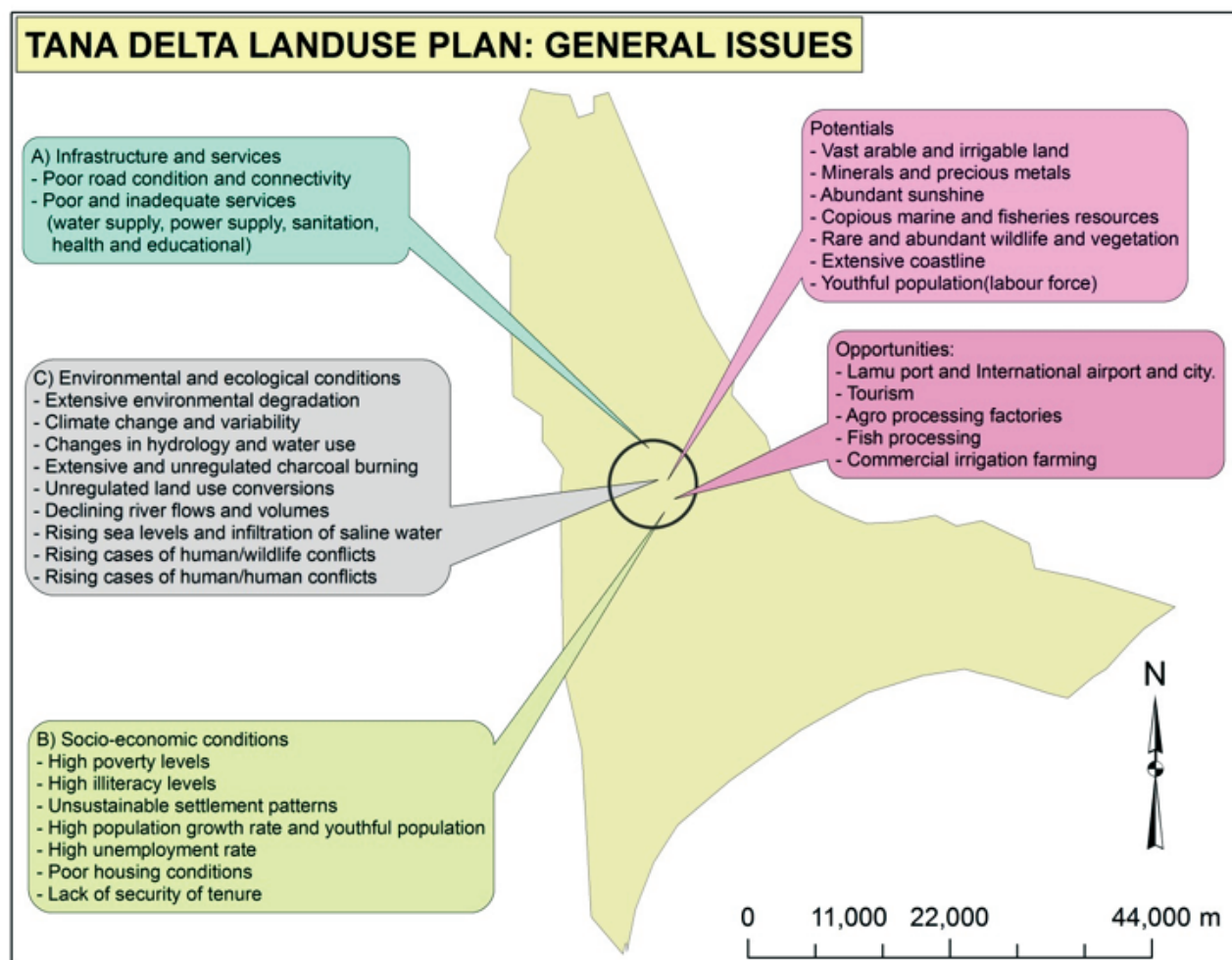
## 2.2.2 Insufficient Employment opportunities and income for Communities

Although 14 The major sources of income for local communities include pastoralism, agriculture, fisheries and natural resource harvesting. These have the potential to deliver more employment and higher income. However, locally developed, small scale, high value agriculture requires good production methods, processing facilities (e.g. abattoirs, milk processing plants) and training in business skills. The Tana Delta is close to tourism centres and its rich cultural diversity, wildlife and landscapes are spectacular and represent potential gains to poor local people and Kenyans at large but these opportunities are not being maximised. Diversifying income streams using local sustainable resources is possible, but requires initial planning, capital investment, support and training.

## 2.2.3 Water Resources

Kenya is expected to experience a slight increase in the amount of rainfall over the next 50 years as a result of climate change but the country will also be exposed to higher temperatures and high levels of evaporation. There are significant amounts of groundwater in some regions, but not within the Tana Delta. There are also opportunities to construct small-scale rainwater retention dams on lagas (seasonal streams). Consequently, the amount of water flowing in the River Tana and available for use is unlikely to increase but the demands upon the river are growing very rapidly. Exploitation of water resources in the upper catchment, through dam construction and diversions, has already led to a significant change in river flow. The frequency and duration of major floods has been reduced, while there has been some small increase in minimal flows during the dry seasons as a result of increased storage and daily releases from existing upstream dams. Dam construction in the upper catchment has greatly reduced the sediment load carried by the River Tana, which reduces the amount of silt reaching the Delta.

**Figure 2.3 General Planning Issues in the Tana River Delta**



This in turn leads to a reduction in soil fertility. Over the next 20 to 40 years some very ambitious projects are planned in the region, including power generation from the new High Grand Falls Dam, development of the Lamu Port South Sudan Ethiopia Transport (LAPSSET) corridor, and extensive irrigation. In theory, all of these uses could be accommodated but only if a large regulating reservoir is built, as an integral part of the first phase of the High Grand Falls Dam in the middle River Tana Basin, in which surplus water can be stored until it is needed.

There are currently no firm plans to build this storage reservoir and without it water development upstream will have serious impacts on the lower River Tana and the Tana Delta.

#### **2.2.4 Resource Use Conflicts**

Shortage of water has been a major contributory factor to the recent conflicts in the Tana Delta as some sections of the pastoral and farming communities have fought over access to the river and the damage caused to crops by both livestock and wild animals. These problems become particularly acute during the dry seasons when very large numbers of cattle are driven from remote areas to the Delta in order to find grazing and water.

#### **2.2.5 Population Dynamics**

The population of the Tana Delta has increased significantly in the last 40 years and will continue to rise over the next four decades unless measures are taken to encourage voluntary family planning and to discourage the number of people who are migrating into this coastal region in search of land and the prospect of work. Detailed analysis through the use of scenarios and SEA has shown that the area of the Delta could not support a trebling of population from around the current 100,000 to over 300,000 by 2050 without fundamental changes in lifestyle and the destruction of the area's unique habitats and environment. Even a doubling of the population, which is expected to occur by 2035, would greatly add to conflicts over diminishing natural resources and conflicts over rights to land and water.

#### **2.2.6 Local Communities are not represented in Governance Processes affecting the Delta**

Local communities are already aware of the negative impacts of uncoordinated development, for example, the failed Tana and Athi Rivers Development Authority (TARDA) irrigated rice scheme in the 1990s left a legacy of poverty and environmental damage. Furthermore, pastoralists complain that the allocation of land by government to large-scale development proposals conflicts with pastoralists' traditional rights, not recognised in statutory law. However, the communities are largely unorganised, especially the most isolated and

marginalised, and their views on development proposals do not have formal recognition within the decision-making process.

Historically, many decisions on land use in the Tana Delta were taken without regard for the interests of the resident population and the local communities who have held the land in trust for generations. This has resulted in large areas of the Delta being held in disputed ownerships and a lack of transparency over land rights and development proposals. This Land Use Plan makes a new start by considering the legitimate needs of communities and the potential uses of land without regard to ownership structure. The plan itself cannot alter any legitimate or disputed agreements over land rights, which are rightfully matters for the National Land Commission (NLC) and the courts. But the plan does make clear what types of use of land and water are considered acceptable in both the national and local interest and, as a result, the plan will have major influence over the way in which land disputes are settled.

#### **2.2.7 External Investment**

The social and economic changes outlined above require that strategies, projects and investments are developed for the benefit of the Tana Delta communities and the nation as a whole. The Tana Delta contains exceptional resources and should be managed and exploited sustainably. Unfortunately, many previous proposals for investments have been conceived largely for the benefits of external interests whether of the state or private business. These development strategies had three major failings in common. Firstly, they ignored the hydrological constraints imposed by the River Tana's flood regime. Secondly, they assumed that the land was vacant and ignored the existing rights and occupation of land by local people. Thirdly, they ignored the symbiosis which exists between human activity, land use and the outstanding natural environment of the Delta. This Land Use Plan seeks to provide major development opportunities within a framework in which the overall resources of the Delta are managed sustainably.

#### **2.2.8 Social and Cultural Influences**

The diverse ethnic background and cultures of the Tana Delta communities add greatly to its special qualities and in accordance with the Constitution they should be respected and protected. However, future demands for resources within the growing population will mean that some changes in lifestyle are inevitable. Change is also necessary in order to combat severe poverty and to provide better education and health facilities for all. The need for these lifestyle changes will need to be addressed by all members of the community in overcoming local rivalries which can lead to conflict.



### 2.2.9 Climate Change

The Tana Delta already experiences wide fluctuations in climatic conditions including pronounced flooding and droughts. The immediate coastline can receive more than 600 mm of rainfall in a year while only 50 km inland rainfall may be less than 300 mm. In these circumstances local people are well adapted to coping with climatic fluctuations on a seasonal and annual basis. However considering the timescale of the Land Use Plan which extends to 2050 it is possible that global warming and rising sea level will already start to have a significant impact on the Tana Delta. In the next 20 years there may be more prolonged rainfall and flooding events (although these may be counteracted by the building of the High Grand Falls Dam). In the next 40 years a possible increase of 15-25 cm in mean sea level could seriously reduce the scope of farming on those parts of the lower floodplain lying within 20 to 30 km of the coast. Any such changes will be gradual and providing contingency and adaptation measures have been properly developed and implemented, there is no reason why they cannot be accommodated within this Land Use Plan.

### 2.2.10 Ecological Condition

The international value of the ecology of the Tana Delta has been recognised in its identification as an Important

Bird Area (IBA) by BirdLife International and designation as a Ramsar site (wetland of international importance) by the Kenyan Government. Ramsar sites should be managed in accordance with the principle of wise use (essentially sustainable development). However, the following challenges are faced within the Tana Delta:

- Destruction and loss of some key habitats as a result of over-exploitation, poor land use practices, encroachment and unplanned and unregulated human settlement, and unsustainable agricultural development.
- Declining water quality due to increased pollution and siltation from the upper catchment.
- Inadequate communication, education and awareness on Delta management issues
- Uncoordinated research and monitoring programmes that do not adequately inform the management of Delta resources on issues affecting them.
- Inadequate mechanisms to address risk management issues affecting the Delta such as climate change, drought, floods and tsunami and storm surges.
- Inadequate partnership and cooperation between government, private sector and non-governmental organizations.
- Inadequate actions to preserve and conserve natural and cultural heritage within the Delta ecosystem.

# CHAPTER 3

## VISION, GOAL, OBJECTIVES AND GUIDING PRINCIPLES

### 3.1 Introduction

The Tana River Delta is a special place which has international recognition as a Ramsar site because of its wetlands and rich biodiversity and presence of indigenous peoples. It is home to more than 100,000 people who have adapted their indigenous way of life and their livelihoods to the dynamic conditions which include both extreme floods and droughts.

In recent decades the Delta's unique characteristics have been threatened, as noted in the previous chapter, by reductions in water flow, due to development in the upper and middle catchment of the River Tana, and by poorly planned and executed developments that have failed to take account of local needs or the special environmental conditions in the Delta.

If the special qualities of the Delta are to be preserved for the benefit of present and future generations it is important that a clear vision, goals and guiding principles

are set, and that the mechanisms for securing these are defined in the Land Use Plan.

### 3.2 The Vision and Goal

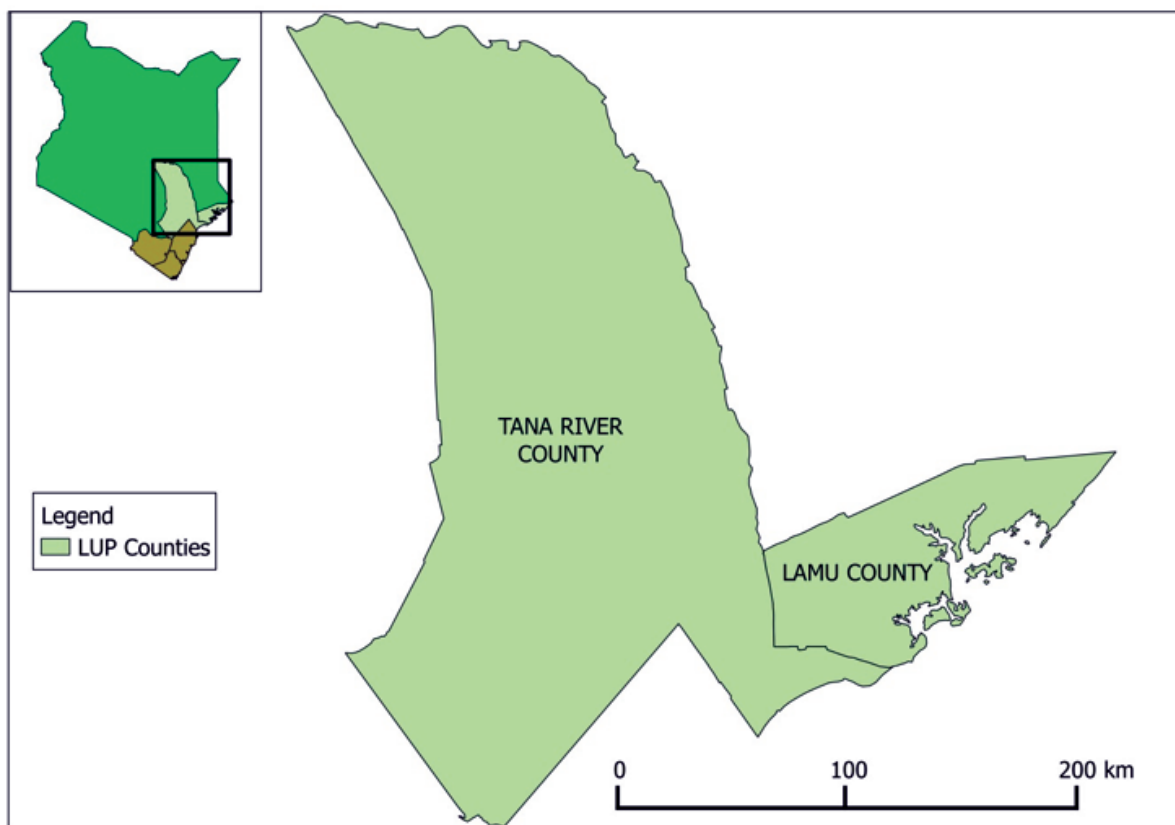
#### Vision

"Land in the Tana Delta is managed sustainably by and for stakeholders ensuring ecological integrity and sustainable livelihoods for present and future generations".

#### Goal

"To contribute to this vision, future land use in the Tana Delta will be administered by the Government at national and county level in accordance with the Land Use Plan. The plan will ensure that all resources (human, land, water, wildlife, vegetation and minerals) are used within the natural carrying capacity of the Delta to improve the quality of life for local people, strengthen the local and national economy and sustain the exceptional biodiversity of this ecosystem".

**Figure 3.1 Tana River Delta Land Use Plan Counties**



### **3.3 Establishing Guiding Principles**

This vision will only be achieved if certain principles and conditions can be satisfied. These are discussed in the paragraphs which follow.

#### **3.3.1 Available Resources**

The Plan Area covers 225,000 hectares and there is strong competition for use of land and water between different elements of its resident communities and also with those who bring animals to graze and drink during the dry seasons. These resources are finite and are already being eroded by competing interests upstream. They are also being exploited by an ever-increasing number of people as the population rises from natural growth and inward migration to the Delta.

If the resources of the Delta are to be used within its natural carrying capacity, this will necessitate restrictions on activities that squander land or water unsustainably and, ultimately, on the numbers of people who can occupy the Delta.

#### **3.3.2 Efficiency of Use**

In the past, land in Tana Delta has been allocated or appropriated for specific uses and then held for long periods of time without any form of beneficial land use. All land in the Delta has existing uses and values and should only be allocated in future for other types of use if these new uses demonstrate clear overall benefits to the communities, environment and economy and avoid inefficiency of use.

#### **3.3.3 Stewardship, Accountability and Responsibility**

Everyone who uses the natural resources of the Tana Delta has an obligation under the constitution to respect the environment for their own and future generations and this requires every land user to show proper stewardship, accountability and responsibility for the way they use land and water.

#### **3.3.4 Equitable, Fair and Timely Planning Decisions**

Future decisions will be taken by the relevant authorities in an open and transparent manner without unnecessary delay and all interested parties including groups that are often marginalised such as youths, women, the elderly and infirm will be included in participation and consultation processes.

#### **3.3.5 Precautionary Principle**

The fragile and irreplaceable natural assets of the Tana Delta need to be protected against un-informed decision making which could cause permanent loss or damage. Where insufficient information is presented to support new development, and there is a potential risk to the

environment, social and/or cultural assets of the Delta, such development may be refused on the grounds of prematurity until the relevant research and information has been gathered.

#### **3.3.6 Public/Private Partnerships**

Public private partnerships in the Tana Delta will deliver benefits to the people and ecosystem of the Tana Delta with no net loss to people and natural capital. A public-private partnership (PPP) is a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. There are usually two fundamental drivers for PPPs. Firstly, PPPs enable the public sector to harness the expertise and efficiencies that the private sector can bring to the delivery of certain facilities and services traditionally procured and delivered by the public sector. Secondly, a PPP is structured so that the public sector body seeking to make a capital investment does not incur any borrowing. Rather, the PPP borrowing is incurred by the private sector vehicle implementing the project and therefore, from the public sector's perspective, a PPP is an "off-balance sheet" method of financing the delivery of new or refurbished public sector assets. There are lessons to learn from the TARDA scheme, which was not a PPP, hence leading to net loss as tax payers are servicing loans for a failed scheme.

#### **3.3.7 All Elements of the Plan should help to Implement the Constitution**

Responsibility for granting licences for the use of land in Kenya lies with the National Land Commission and with the new county governments. In future, all land use decisions will need to be weighed carefully to ensure that society as a whole benefits from use of land and not just powerful individuals, elites and corporate bodies. Each planning application for use of land in the Delta will need to be accompanied by a carefully researched justification of the proposal demonstrating how it will benefit the local community in terms of reducing poverty, increasing food security, creating employment or strengthening communities in other ways; how it will improve economic performance in the Delta and the wider region and how it will protect and enhance the natural environment. If this information is submitted in an open and transparent manner the decision-making body should respond quickly and fairly; delay will only be necessary in controversial cases where more time is needed for consultation or if the planning documents are inadequate. The principle of subsidiarity will be applied in recognition that certain decisions and actions are best made at local levels.

### **3.3.8 Ecosystem-based Approach**

An ecosystem-based approach will be adopted which recognizes the relationship and inter-linkages between all components of the wider ecosystems including the human/social components, the upper catchment zones and the river basins.

### **3.3.9 Upholding the Rule of Law**

Future decisions will observe policy and legal instruments, including existing national policies, regulations and guidelines and legislation domesticating international interests in management of deltas set out in Multilateral Environmental Agreements (MEAs) and Regional instruments.

### **3.3.10 Application of the Polluter Pays Principle**

The Polluter Pays Principle will be applied where those who pollute the Tana Delta ecosystem meet the full cost of cleaning/restoration and the cost of pollution to the resource users.

### **3.3.11 Co-operation, Collaboration and Integration**

Most land uses in the Tana Delta require co-operation, collaboration and sometimes integration with adjacent projects and schemes to maximise the way in which land and water is used and avoid unnecessary conflict. Elements of the Land Use Plan have been designed to maximise opportunities for co-operation, collaboration and integration.

### **3.3.12 Decisions will be based on Sound Scientific Evidence and Experience**

It is common for land to be acquired speculatively or for projects to be submitted for an environmental licence before they have been properly tested against the body of scientific evidence. The Land Use Plan will encourage carefully researched and piloted projects before allowing large scale development to take place and adaptive management principles will be applied.

### **3.3.13 Planning Policies will be Flexible to Accommodate Changing Circumstances**

The Tana Land Use Plan is designed to cover a twenty year time horizon and it is certain that conditions will change over that timescale. Consequently, the plan will need to be revised and refined at five year intervals to ensure that it is kept up-to-date.

### **3.3.14 Respect for Property Rights**

In accordance with the Constitution, land ownership in Kenya will be subject to review by the National Land Commission. Different forms of tenure exist and in some cases historical injustices have to be redressed. However, in the longer term the plan will encourage clear and unambiguous forms of land ownership in order to avoid the sort of land disputes that have occurred in the past.

# CHAPTER 4

## NATIONAL AND INTERNATIONAL POLICIES

### 4.1 Policy Context

This Plan builds on the Constitution of Kenya (2010), national policies and international conventions. It places particular emphasis on the importance of local communities and on the exceptional environmental qualities which make the Tana Delta of international importance for its biodiversity. The preamble to the Constitution of Kenya notes (amongst other things) that: “We the people of Kenya; proud of our ethnic, cultural and religious diversity, and determined to live in peace and unity as one indivisible sovereign nation; and respectful of the environment, which is our heritage, and determined to sustain it for the benefit of future generations - have adopted the constitution”.

The importance of land and environment is highlighted by the fact that a complete chapter (5) of the Constitution is devoted to it. Section 60 (1) states that:

“Land in Kenya shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable and in accordance with the following principles –

- a) equitable access to land;
- b) security of land rights;
- c) sustainable and productive management of land resources;
- d) transparent and cost effective administration of land;
- e) sound conservation and protection of ecologically sensitive areas;
- f) elimination of gender discrimination in law, customs and practices relating to land and property in land; and
- g) encouragement of communities to settle land disputes through recognised local community initiatives consistent with this Constitution”.

The Constitution emphasises the role of a national land policy and the National Land Commission in settling disputes and directing future policy.

Other important obligations of the state are set out in section 69 (1) as follows:

- a) “ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources, and ensure equitable sharing of the accruing benefits;
- b) protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- c) encourage public participation in the management, protection and conservation of the environment;
- d) protect genetic resources and biological diversity;
- e) establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- f) eliminate processes and activities that are likely to endanger the environment; and
- g) utilise the environment and natural resources for the benefit of the people of Kenya”.

A number of the obligations set out in the Constitution remain to be converted to acts of parliament and policy by the government. However, there are many existing policies, laws and regulations which do give effect to these principles and these have been examined as part of the planning process. This analysis highlighted the importance of the Constitution and drew attention to Vision 2030, and individual policies on land, water, agriculture, forests, regional development, and irrigation. Not surprisingly, policies sometimes contain elements that conflict with one another, especially where a number of different aspirations are being promoted within the same physical area. So, for example, developing agriculture or irrigation can prove to be a challenge in water-stressed catchments while large scale tourism could be incompatible with protection of a forest reserve. A key element in this Land Use Plan has, therefore been to review all national policies and test them for consistency against each other and in relation to the vision, goal and objectives of the Tana Land Use Plan. **Figure 4.1** below illustrates the degree of consistency and compatibility between some of the key policies. Details of the policy analysis are contained in Appendix 1, Part 2.

Figure 4.1 Consistency Analysis

Policy Interactions Matrix															
	Constitution	Water	Irrigation	National Land	Tourism	Agriculture	Food Security	Forestry	Wildlife - Biodiversity	Regional Development	energy	environment	Climate change	fisheries	Mining?
Constitution															
Water	?														
Irrigation	?	?													
National Land		?	?												
Tourism	?	?	?	?											
Agriculture		?			?										
Food Security		?	?		?										
Forestry		?	?		?										
Wildlife - Biodiversity		?	?		?										
Regional Development			?		?										
Energy		?	?		?										
Environment	?	?	?		?	?	?	?	?	?					
Climate Change	?	?	?	?	?	?	?	?	?	?	?	?			
Fisheries	?	?	?	?	?	?	?	?	?	?	?	?	?		
Mining?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	
Social					?										

	Highly compatible - no conflicts of interest
	Compatible - only minor differences of emphasis
	Neutral both supporting and opposing elements between the two policies
	Incompatible - some important differences in terms of objectives
	Highly incompatible - policies are directly opposed to each other

## ANTICIPATING LONG TERM REGIONAL TRENDS

### 5.1 Introduction

The Tana River Delta is located in a part of Kenya that will undergo very significant changes in the next 50 years. These include variations in temperature, rainfall, river flow and biodiversity as a result of global warming but also major changes in the region's economic and social conditions arising from government policy and individual and corporate initiatives.

In considering developments over the next 17 years it is possible to build up a picture of change based on specific proposals contained in Vision 2030 and other strategic documents like the National Water Management Plan, 2030. However, the situation beyond 2030 is likely to be much more fluid. The Strategic Environmental Assessment which accompanies this Land Use Plan has examined the likely pattern of change up to 2030 and 2050, from which the following key conclusions are drawn.

### 5.2 Changes to 2030

#### 5.2.1 Water Resources

Work is expected to start on the High Grand Falls Dam within the next two years and this reservoir would then take 3 to 4 years to fill. Production of electricity and the development of irrigation could therefore commence around 2020. During the filling stages, retention of floodwater could reduce the amount of water reaching the Tana Delta so the County Governments will need to work closely with Water Resources Management Authority (WRMA) and Kengen to ensure that any adverse effects are minimised. An additional storage reservoir is currently proposed for construction in 2027, but the SEA findings have demonstrated that this work needs to commence in parallel with the HGFD if major damage to the Tana Delta ecosystem and livelihoods is to be avoided.

#### 5.2.2 The Port of Lamu/ Lamu-Port-South-Sudan-Ethiopia-Transport Corridor (LAPSSET)

Development of a new port at Lamu, which is one component of the LAPSSET corridor, is potentially one of the largest construction enterprises on the African continent. The speed at which it progresses will be dictated by the availability of funds but over the timescale to 2030 it is likely that a new city will have been created around the port together with an oil refinery, new industrial area and other major infrastructure. This development will generate significant demand for

labour, food and water. The Tana and Lamu County Governments and other government agencies will need to work closely together to maximise the benefits of this investment for the entire sub-region. The project should create work for residents of the Tana Delta and opportunities to provide goods and services to the new city. At the same time the county governments must take steps to ensure that the needs of the Delta itself for water and land are properly protected.

#### 5.2.3 Business Development

New investment in the region will provide an important economic stimulus which the Tana Delta is well-positioned to take advantage of. As the port expands there will be scope for developing export trade particularly in meat, fish, fruit and vegetables and the plan anticipates the creation of four industrial sites in Garsen, Witu, Tarasaa and Kipini.

#### 5.2.4 Wildlife and Nature Conservation

The trends outlined above will put increasing strains on the environment and natural habitats within the Tana River Basin and elsewhere in Kenya. These pressures will become more pronounced on land within and adjacent to protected areas and important migratory corridors used by wildlife. In these circumstances the protection and preservation of unique ecosystems like the Tana Delta will become an even higher priority than it is at present.

#### 5.2.5 Population Growth

The local population of the Tana Delta is expected to continue growing from around 102,000 people in 2010 to 175,000 by 2030, thereby increasing demand for land and natural resources.

### 5.3 Changes from 2030 to 2050

#### 5.3.1 Water Resources

Successful development of the High Grand Falls Dam and regulating reservoir will require a detailed water balance and allocation plan in order to meet a wide range of objectives, including nature conservation, irrigation, commercial and domestic use in the lower River Tana basin. Responsibility for these plans will be in accordance with the Water Act (2002), but need to be coordinated with the county governments. There is also a need for regular inter-county consultations on water resources along the River Tana.



### 5.3.2 Irrigation Development

Plans for irrigation development are currently being drawn up throughout Kenya in line with the government's declared intention to create one million acres of new irrigation by 2030. Since the River Tana carries 70% of the national fresh water flow it is certain that a significant proportion of this irrigation will need to be located within, or adjacent to, the Tana catchment. Current proposals include renovation of the Hola and Bura irrigation schemes and promotion of irrigation on the Galena Ranch which falls partly within the River Athi and River Tana Catchments.

Previous efforts to develop irrigation within the Delta and at Hola and Bura proved to be very expensive and failed to capitalise on the initial investment. As irrigation works are carried out, it is essential that these are designed around the same sustainability principles that have been adopted in this Plan for the Tana Delta itself. The County Governments, as managers of the Tana Delta Land Use Plan, will insist that any irrigation development which takes place upstream is designed to return surplus water to the River Tana channel rather than diverting it to neighbouring catchments.

### 5.3.3 Business Development

Expansion of the Lamu Port and surrounding area will continue creating potentially one of the strongest growth zones in Kenya. Development of the strategic road infrastructure and new power distribution network will create major opportunities for Delta settlements and Garsen in particular because of its strategic position at the junction of roads leading to Nairobi and Mombasa. It is a major component of this plan to capitalise on the development to process Tana Delta products and market these throughout Kenya.

### 5.3.4 Wildlife and Nature Conservation

The trend of increasing pressure on a diminishing area and range of natural habitats will continue and this could lead to permanent damage to the Tana Delta. However its status as a Ramsar site demands that serious efforts are

made to protect and enhance key habitats. Maintenance of the habitats represents a major challenge but there is also an excellent opportunity for stimulating ecotourism and generating major financial resources for the area.

### 5.3.5 Population Growth

The demand for natural resources including land and water will continue to grow across Kenya throughout the next 40 years. If population continues to rise at its previous rate of 3% a year this will lead to a doubling of the national population within 30 years. The equivalent growth rates within the Tana Delta will raise the population level from 175,000 people in 2030 to 315,000 in 2050. Experience in other countries has shown that the natural rate of population increase slows down as a country becomes more prosperous. However individual wealth, education and living standards can lead to widely different standards within each country. Unless there are some dramatic improvements in social and economic conditions within the Tana Delta population expansion is likely to continue, with serious risks of social instability and conflict.

## 5.4 Key Messages and Recommendations for the Plan

The changes anticipated over the next 20 to 40 years require that a number of actions are taken in relation to the Tana Delta Land Use Plan. These include:

1. Strong representation by the County Governments to ensure that the resource interests of the Tana Delta and adjacent areas are properly considered and addressed in national plans for water resource and irrigation development.
2. A positive economic strategy is pursued to maximise opportunities for sustainable development associated with the Port of Lamu and LAPSET corridor.
3. The true economic value of the Delta ecosystem should be recognised in all future development planning and creative and imaginative programmes for securing investment in ecotourism and management of carbon resources should be pursued.

# CHAPTER 6

## THE PLAN AREA AND PLANNING ZONES

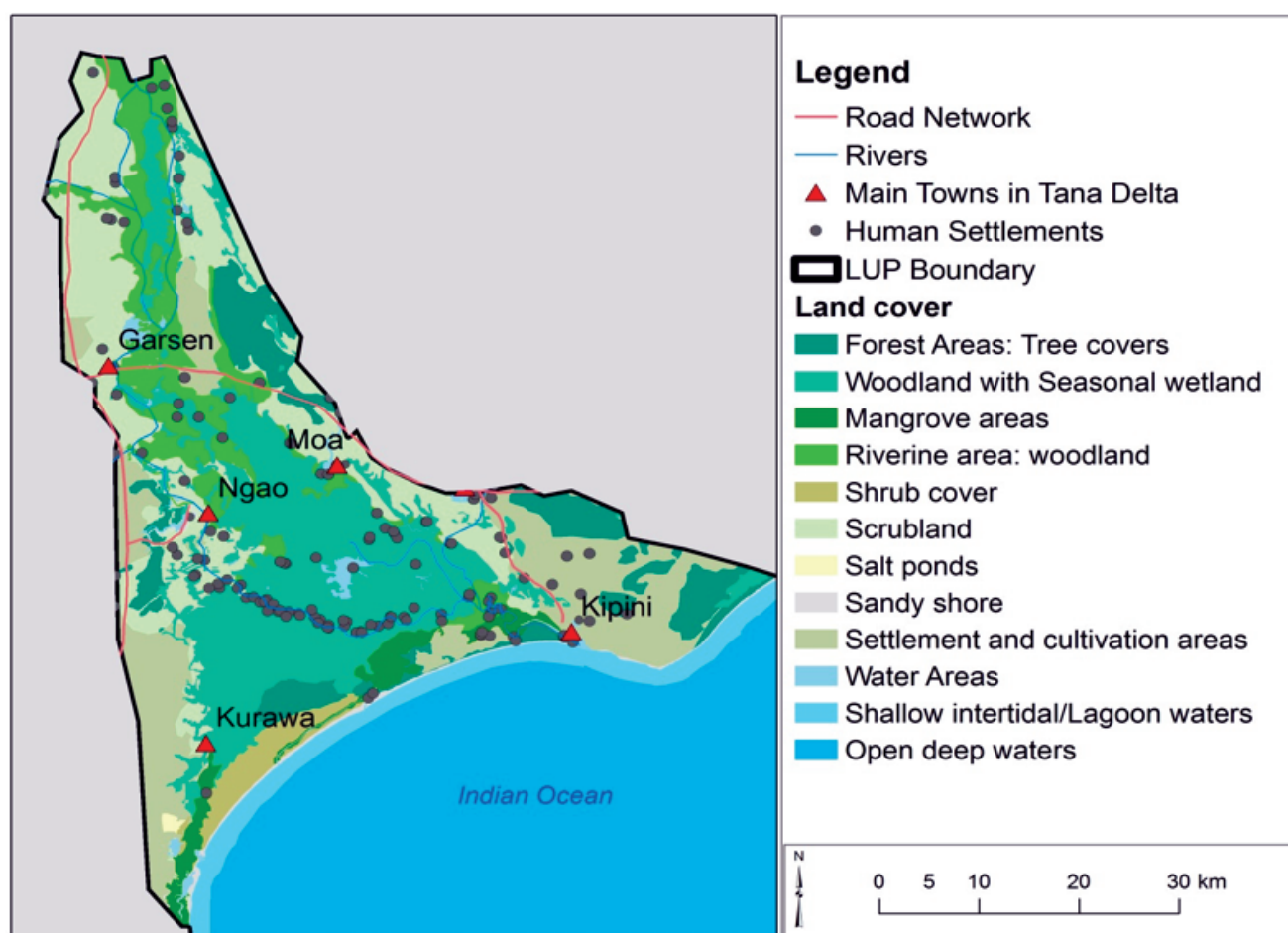
### 6.1 The Plan Area

In order to assist the process of making future decisions on land use and development in the Tana River Delta the area has been divided into a number of Planning Zones. The process of defining Planning Zones is described in Chapter 6 (Part 2).

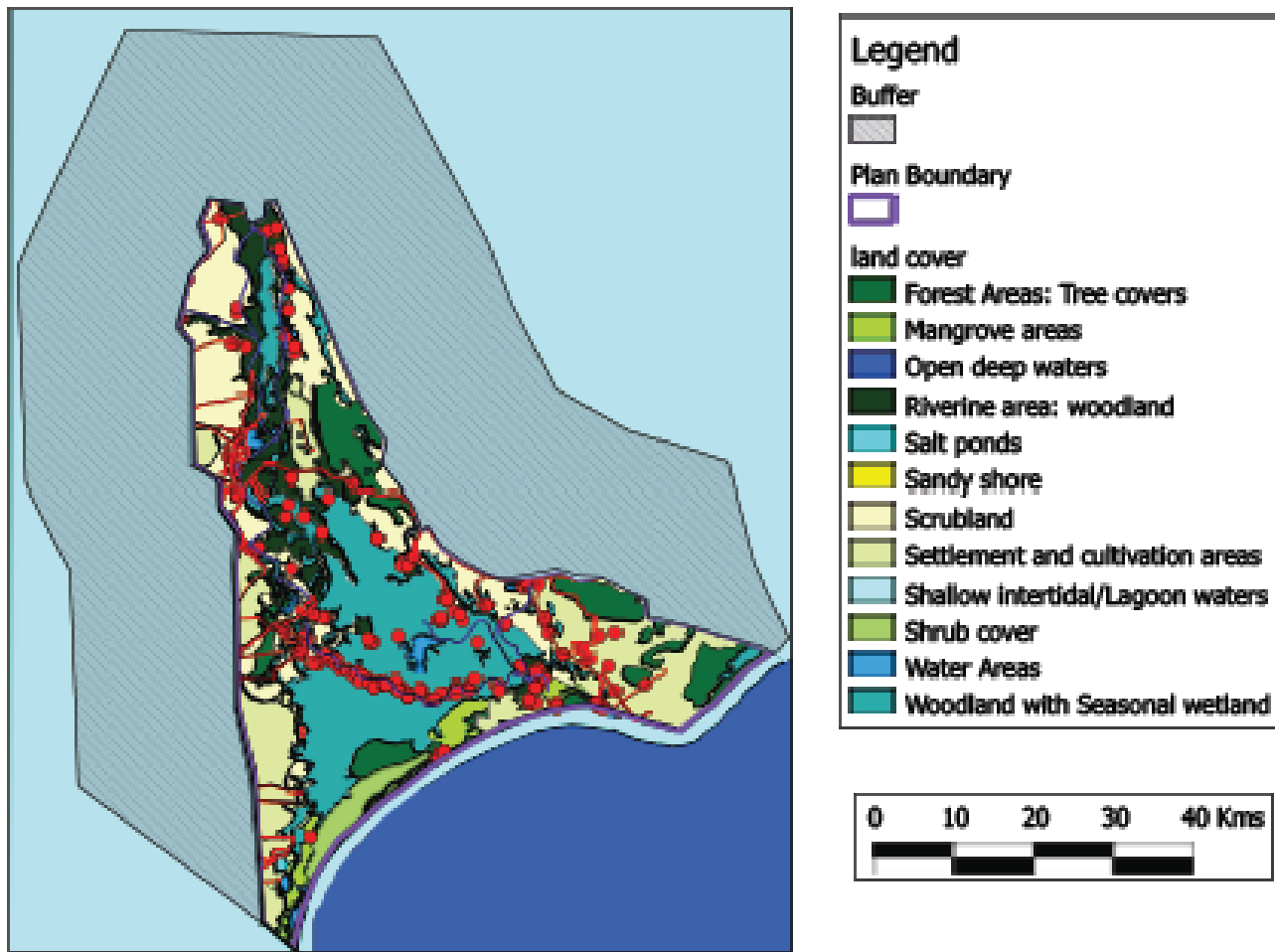
The Land Use Plan relates to two principal zones:

- the Delta, which includes all areas affected by River Tana from the Primate Reserve to the sea, (See Plan 6.1) and,
- the Buffer Zone, which extends from the boundary of the Delta outwards to a minimum distance of 20 kilometres (See Plan 6.2).

**Figure 6.1 Map Showing the Tana Delta Plan Area**



**Figure 6.2 Map Showing the Extent of the Tana Delta Plan Buffer Zone**



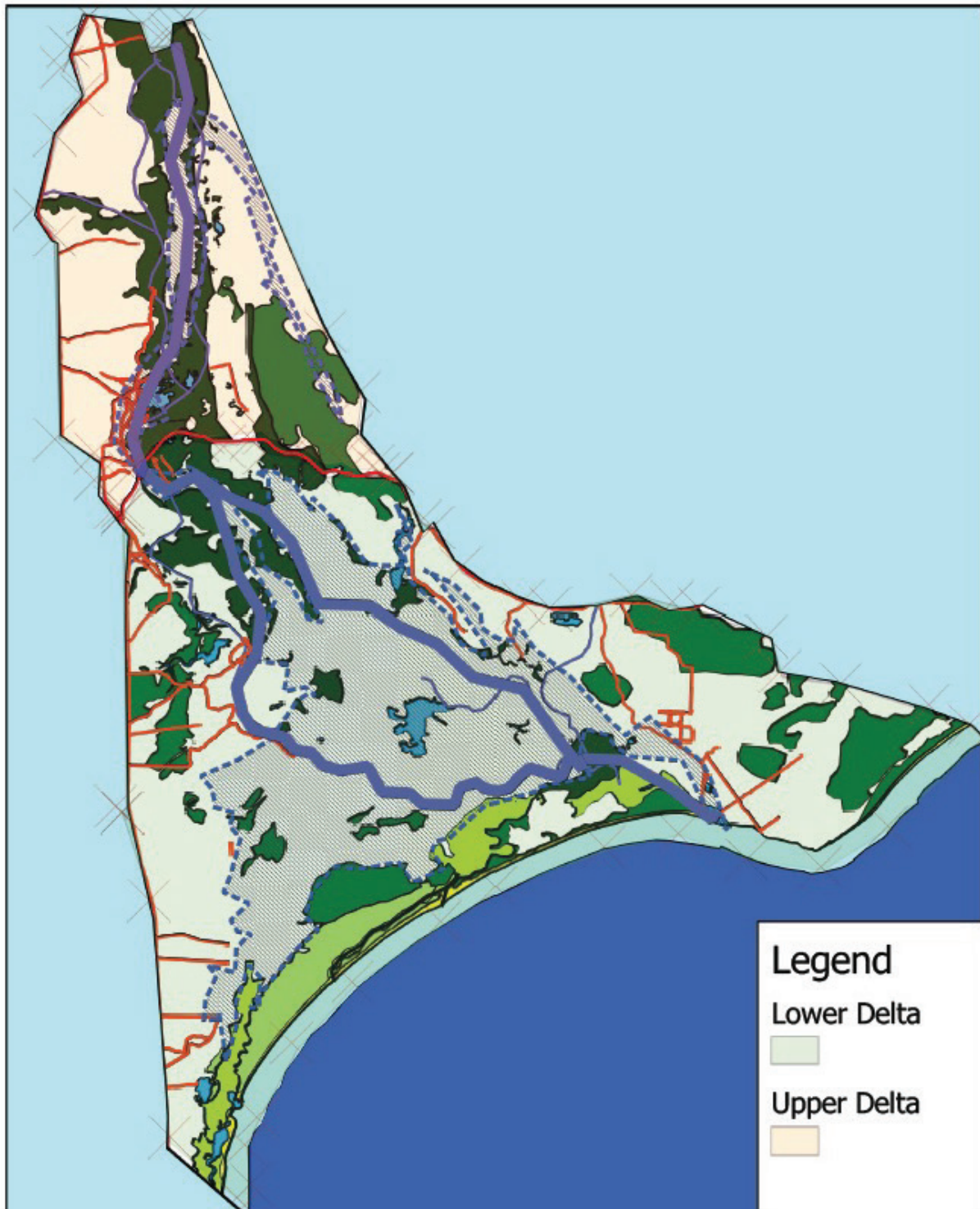
The Delta includes the whole of the River Tana Delta from the Primate Reserve to the sea and the higher ground (terraces) on either side within the boundaries of the main Malindi-Hola highway. It also includes an area of land lying to the north of the Garsen - Witu road which falls within the administrative area of Tana River County and a triangle of land extending from the Witu-Kipini road to the sea which forms part of Lamu County.

Within the Delta a distinction is made for planning purposes between the Upper Delta (lying between the Primate Reserve and the Garsen - Witu Road) and the Lower Delta (which extends from the Garsen - Witu Road to the sea) (See Plan 6.2). The Lower Delta has been defined broadly in line with the boundary of the Ramsar

designation. The distinction between Upper and Lower Delta is not only based on topography, but the fact that much of the Upper Delta has been transformed by large-scale cultivation. Whereas in contrast, two-thirds of the Lower Delta retains a natural character, albeit under increasing pressure from grazing and encroachment by semi-permanent cultivation.

The Buffer Zone extends twenty kilometres beyond the boundaries to the Delta Core and includes dry thicket, rangeland and ephemeral river valleys (lagas) that are identical in character to the terraces. In practice there is little to differentiate any of this land that extends all the way to Tsavo East, and in a north-easterly direction to Ijara from the terraces.

**Figure 6.3 The Upper and Lower Delta**



## 6.2 Existing Character of the Planning Zones within the Delta

### 6.2.1 Topographic Zones

For planning purposes four topographic zones are described in the Delta, these are: River Corridors, Flood Plain, Terraces and the Coastal Belt (See Plan 6.4 and Box 6.1).

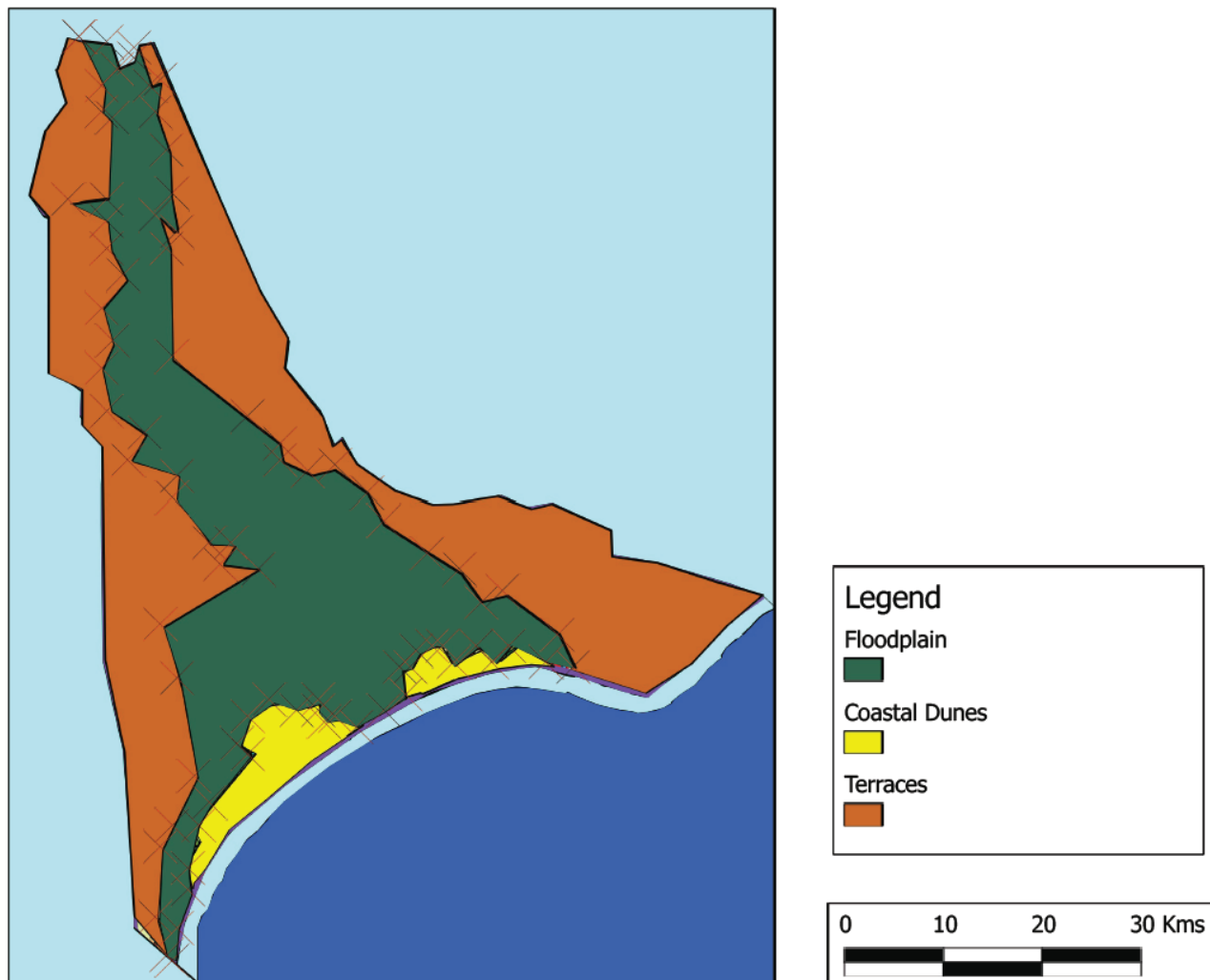
### 6.2.2 River Corridors

The River Tana has flowed along many different routes through both the upper and lower parts of the delta in the last one thousand years. In the last one hundred years the river's route has passed close to Garsen and then headed through part of the Western terrace (the Oda branch) before crossing the lower floodplain to the sea (Hamerlynck, 2010). Before 1800, the river flowed south to Mto Tana, but the excavation of a

canal to provide navigable access from Kipini resulted in the complete realignment of the river's course during floods in the late 19th century and the isolation of land and villages along the former route to Mto Tana, which continues to have serious implications for land use and biodiversity today (Hamerlynck, 2010).

In 1962 the lower River Tana was again diverted by floods and cut a new exit to the sea in the central section of the sand dunes at Shekiko (Hamerlynck, 2010). This network of channels continues to provide a release route for floodwaters (and an inlet for saltwater incursion), but the main outlet today is through the Kipini estuary. As recently as the 1980s, further attempts were made to divert water from the River Tana for agricultural use, involving excavation of the Matomba brook, in order to serve new villages below Idsowe bridge. This had unexpected consequences and the Matomba branch has

**Figure 6.4 Topographic Zones, River Corridors, Floodplain, Terraces and Coastal Plain**





### BOX 6.1 Topographic Zones

**River Corridors (45Km<sup>2</sup>)**–The current channels of the River Tana have a critical function in dictating which areas of the Delta receive water, especially in the dry seasons and have historically determined where settlements are built.

**The Flood Plain (700 Km<sup>2</sup>)** – This is the area over which the River Tana has meandered in historic times and it covers nearly 70% of the total Delta. Most of the flood plain was inundated twice a year during the long and short rains until dams were constructed in the Upper Tana Basin. It still experiences frequent, if less reliable, flooding in most years.

**The Terraces (1402 Km<sup>2</sup>)** – These are areas of higher ground which flank the flood plain on both the western and eastern sides of the Delta. The terraces are former marine shorelines and are generally drier than the flood plain with extensive thicket and scrub vegetation.

**The Coastal Belt (103Km<sup>2</sup>)**– The floodplain of the Delta is separated from the sea by a crescent of sand dunes rising up to 50 metres above sea level. On the seaward side there is a wide sand beach and on the landward side the dunes are flanked by forest and mangrove.

now become the main channel of the River Tana which discharges into the central floodplain. Parts of the river's route are confined within a recognisable channel but in other areas water flows through a multitude of minor depressions, swamps and channels, which change each year, before rejoining the main river near Ozi and flowing to the sea at Kipini (Maingi & Marsh, 2002).

A key characteristic of deltaic rivers is for the annual load of silt and sediment which is brought down by flood water from the highlands to be deposited across the floodplain with the coarser, heavier particles settling out first as the current slows while the finest silt is swept into the grasslands (Kitheka, 2002). This annual pattern of deposition leads to the build-up of ground levels immediately adjacent to the river banks so that the natural 'levees' that result to may be 1 or even 2 metres higher than the surrounding flood plain (Odhengo *et al*, 2014a). The higher ground along the river corridor serves a very valuable role as the location for permanent settlements and for cultivation of vegetables, fruits and other crops that can be watered directly from the river (Odhengo *et al* 2014a). Plan 6.6 shows the grouping of villages along the southern river corridor. Although these villages do experience the effects of flooding the depth of water seldom rises above half a metre due to the raised embankments, whereas the floodplains on either side may fill with a metre or more of water (Odhengo *et al*, 2014a).

#### 6.2.3 The Floodplains

The extent of the active flood plain of the River Tana has changed over time and continues to alter in relation to the alignment of the main river channels and the volume of water carried in each flood event. In the past,

all areas lying between the outer extremities of historic river channels have formed part of the flood plain but the active flood plain is now constrained by topography and the reduced river flows to the areas shown in Plan 6.4. Since five dams were constructed in the upper catchment reduction in river flows over the last forty years has been accompanied by a marked reduction in silt carried by floodwater (Hamerlynck, 2012). This has had serious consequences for soil fertility in the Delta because the river's bed load and suspended solids are rich in organic material and nutrients. Construction of the High Grand Falls Dam will further reduce sediment yields to the Lower Tana Basin and Tana Delta.

In prehistoric times most, if not all, of the floodplain would have been covered by forest, with open pools, lakes and marshes in the lowest sections. Remnants of the original forest still exist along the river corridors. This forest was once a continuous zone stretching across Africa. Tana Riverine Forests retain characteristics of this ancient Miocene forest (and elements of West African forest cover) which accounts for its very high biodiversity (Maingi & Marsh, 2002).

The character of the flood plains has changed in the recent past with decreased runoff due to dam construction in the upper Tana River Basin and increased grazing by both wild herbivores and livestock. Today much of the flood plain consists of tall grasses, reeds and open scrub (Odhengo *et al*, 2014a). The high water table maintains very varied wetland vegetation with a dense population of insects, snails, worms, frogs, fish and other animals which provide food for birds and larger animals like crocodile (Odhengo *et al*, 2014a). The richness of the flora and fauna in the intertidal areas and

floodplains account for large concentrations of resident and migratory waterbirds and provides a key reason for designation of the entire Delta as a Ramsar Site. Migrants include the Madagascar Pratincole (with recent observations of over 10% of the world population). Nesting water birds include spoonbills, storks, herons and egrets (Nature Kenya, 2008a).

#### 6.2.3.1 The Flood Plain in the Upper Delta

South of the Primate Reserve, the River Tana breaks up into a number of separate channels which meander over a floodplain which varies from 2 to 6 kilometres in width (Maingi & Marsh, 2002). These channels bifurcate and coalesce in random patterns which alter after each flood event. There is, however, a large water-body, Lake Assa, which expands and contracts according to the amount of water coming from the upper catchments (Knoop, 2012).

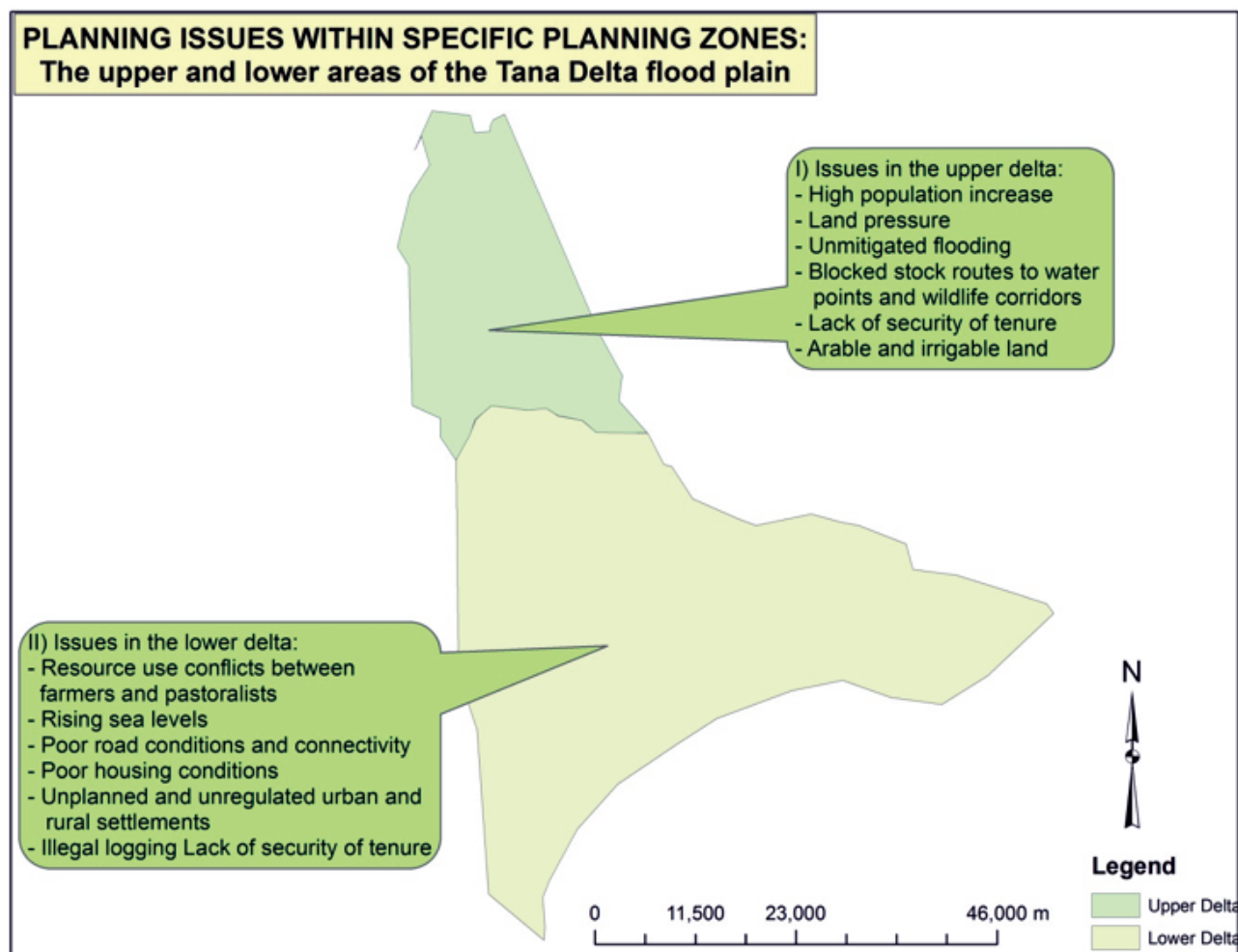
Attempts have been made in the past to canalise parts of the river in order to establish intake points for water

abstraction, including the present intake at Sailoni, but the entire area remains highly dynamic and the power of the flood water easily overwhelms all but the highest and strongest of embankments. Historically the River Tana flowed from north to south along different channels but the construction of the Garsen-Witu road on an elevated embankment has now confined the river to a single exit point under the Idsowe Bridge near Garsen (Knoop, 2012). Nevertheless the river remains free to meander upstream of the bridge and threatens to cut a new channel through the road embankment at some point in the future (Pers. observation).

#### 6.2.3.2 The Central Flood Plain

Construction of the Matomba Brook in 1986 resulted in a major re-alignment of the River Tana which now flows across the Central Flood Plain throughout the year (Harmerlynck, 2012). The flood plain forms a very shallow bowl from west to east although it drops in elevation from 11 metres above sea level to sea level and even descends below mean sea level close to the

**Figure 6.5 Planning Issues within the Upper and Lower Floodplain**





coast, resulting in areas of brackish open water. The entire zone is readily inundated by annual flooding events (Hammerlynck, 2012).

Rising sea level, combined with the reduction of fresh water inflows to the Tana Delta is leading to progressive change in vegetation and potentially land use in the lowest sections of the central flood plain with increasing salinity in soils from periodic flooding with salty water caused by backing up of river water by the flood tides (Knoop, 2012).

The central zone is the largest area of the Delta which retains natural wet grassland, marsh and forest, although the climax vegetation (woodland) is prevented by grazing (Odhengo *et al*, 2014a). During the dry season this vast grassland provides essential grazing and water for hundreds of thousands of cattle, in addition to wild animals like hippo, buffalo and antelope. In extreme drought cattle may be driven into the area from the whole of northeastern Kenya and even the frontier areas of Ethiopia and Somalia (Odhengo *et al*, 2014a).

Permanent villages have been established by the Orma pastoralists, which lie largely on the southern boundary of the zone and can only be reached by crossing the River Tana. These villages include Onkolde, Moa, Dargagalgi, Chalaluma, Didewaride, Onido, Kipao, Mwanja, Odhole, Kikomo, Handaraku, Onwardei, Maderti, Ongonyo, Reketa, Beliangeti, Dibe, Bura Krash, Galili and Gomesa (Odhengo *et al*, 2014a).

The whole zone represents the heart of the IBA. This has a very large number of water birds (herons, egrets, kingfishers and geese, etc) and other wildlife e.g. hippo, crocodiles, buffalo, waterbuck, topi, etc. (Hamerlynck *et al*, 2002) recorded the endangered Tana River Red Colobus and the Tana River Crested Mangabey in Shetani matwari Forest patch within this area. During the dry season, this is a high-risk area due to high concentration of wildlife resulting in wildlife/human conflict. Hippo and other herbivores are major grazers and would disrupt any form of farming.

Orma, Wardei and Somali people from the former North-Eastern province graze large herds of livestock – cattle, goats and sheep – in the central floodplain during the dry season. In the wet season economic activities are limited and artisanal fishing remains the primary economic activity. Existing fish farming is in open water /rivers/lakes. Moa has some fishponds and a landing and processing site. Villagers seek to store water in dug-out fish ponds and natural meanders during the long rainy season (March-June) and short rainy season (Sept-Dec) each year. During the wet season all roads become

impassable and therefore many river channels are used for navigation/transport.

#### 6.2.3.3 The Southern Flood Plain

This area has experienced some very significant changes in flooding regime, land use and settlement since the early nineteenth century when the first canalisation of the river was undertaken. Diversion of the main river from its most southerly outlet to Kipini resulted in the abandonment of settlements along the original river channel (Hamerlynck, 2012). With the exception of Darga, Goshi, and Kibokoni and a newly established Giriama village, most settlement is concentrated on the higher ground of the river levees, along what became the dominant channel of the Tana River between 1900 and 1980 (Hamerlynck, 2012).

Now, once again, human activity is having significant impacts on the settlement and land use pattern as a result of river impoundments and diversions upstream and the global effects of climate change. Reduced flooding and construction of the Matomba Brook has significantly depleted the normal river flow (Kitheka, 2002). At the present time, farmers seek to augment water supplies in the dry season by damming sections of the main river but this is only a temporary option and both water areas and soils in this section of the lower delta are becoming increasingly saline due to sea water incursion (Hamerlynck, 2012).

Areas lying immediately to the south and west of the River Tana have been cultivated for many years, but there are small woodlands and palm groves close to the river and extensive areas of marsh and wetland interspersed with farming areas. Mangrove is found in saline areas close to the river channels that extend to the coast. It is important in providing fish breeding sites (Nyunja *et al*, 2002).

Areas lying closest to the main river continue to be farmed extensively by the resident community of Pokomo, Giriama and other smaller tribes living along the River Tana corridor. The main farming and grazing zone lie between two rivers, which discharge from the Mnazini Brook. Farming practice relies on dryland cropping with limited irrigation for subsistence only. Commercial crops include mangoes, melon, citrus fruits and vegetables such as tomatoes, sukuma, wiki, onions, chilli, etc. Subsistence crops include maize, cow peas, green grams, millet, etc (Odhengo *et al*, 2014a). Rising salinity levels are said to be resulting in reduction of crop yields in some areas (Odhengo *et al*, 2014a).

Efforts have been made to develop an irrigation system to support subsistence agriculture in Ozi community

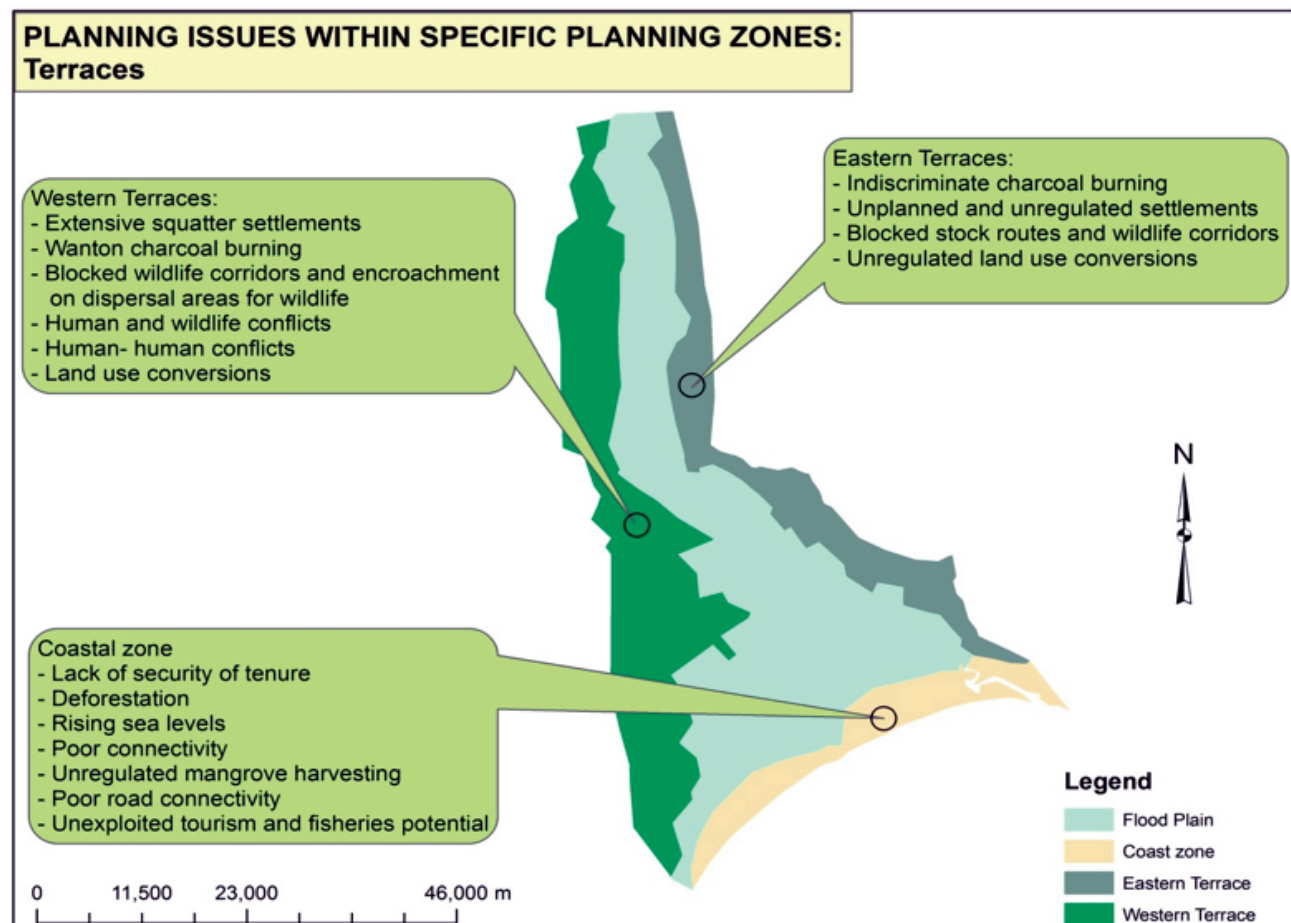
with the intention of extending this to a commercial operation. The scheme comprises a series of small canals used to bring irrigation water from the river but the network has been abandoned due to salt water intrusion (Government of Kenya, 2013). Where farms are already affected by salinity the farmers are forced to try and drain salt. Some water is then pumped from the river during ebb tides to try and recover enough fresh water to feed the farms. However, crabs thrive in the brackish water and have become a pest by feeding on young rice plants. As a result, farmers are increasingly relying on mangoes, coconut and fishing as coping mechanisms (Odhengo *et al*, 2014a).

During the annual flooding events water is discharged from the Tana River through the Furaha Brook and spreads into local channels where fresh water fish breed and are subsequently caught for subsistence. There are several landing sites along the coastal strip which are used by canoes engaged in marine fishing (Hamerlynck, 2012).

The forests in the lower delta are of considerable economic importance including mangroves in Ozi and Chara which support marine fish species especially during spawning (Knoop, 2012). Forest trees are an important source of nectar and bee keeping is practised in Ozi and Chara areas, mostly in Chara where they package honey and sell it locally (to the community) or in Malindi (Odhengo *et al*, 2014a).

A local community group comprising residents of Chara and Ozi has been established to spearhead the sustainable utilisation of the natural resources in the area (forest products, water) and use of these for economic gain. The group, called the Lower Tana Delta Conservation Trust (LTDCT) has developed an initial management plan (c.2005) with support from the Kenya Wildlife Service. The LTDCT promotes awareness creation, advocacy campaigns, collaboration and networking with other investors and NGOs including the development of ecotourism initiatives in both Ozi and Chara.

**Figure 6.6 Planning Issues within the Terraces**



Another important initiative has been the preparation of an Ozi Forest Management Plan (2010). This is a specific plan for Ozi forest produced with support from Nature Kenya and designed to be fully compatible with LTDCT plan and with complementary activities, but having a more detailed focus on the Ozi area.

The first steps have been taken towards developing eco-tourism in association with the LTDCT and a private venture run by the Delta Dunes Lodge/Camp which is located near to the Mto Tana. The Lodge has a private airstrip 35m wide and 1000 metres in length for light aircraft (Odhengo *et al*, 2014a).

At present there is a low level of ecotourism in the lower delta. The Galtama ecotourism group (under the umbrella of the LTDCT) owns a boat and links with Delta Dunes to transport tourists upstream to view aquatic wildlife. This collaborative venture is quite successful since the Delta Dunes Lodge does not have a direct link to river. The Galtama group has a small number of tourist huts but this accommodation is not currently used as it was damaged during the 2012-2013 conflict. Boats and canoes are the key mode of transport using the river network and coast, especially during flooding and rainfall.

In the last ten years, interest has been shown by commercial investors in the possibility of developing the Kon-dertu ranch.

#### **6.2.4 The Terraces**

The terraces are located on both sides of the Delta and are divided into Western and Eastern Zones. These areas are covered largely by acacia and euphorbia species which, in their natural state, form dense, fairly impenetrable, thicket and scrub. The topography is elevated above the floodplain and although localized ponding of rainwater may occur in the wet season, the land is not subjected to annual flooding. Open areas of grassland or bare earth occur in depressions and dry river valleys (lagas) where waterlogged soils exist. The density of the thicket/ bushland is governed by levels of human and grazing activity. Clearance by burning or cutting thicket has created large open areas close to settlements which are then kept open by constant grazing. Due to the dry sandy soils, low rainfall and semi-arid nature of the vegetation, the principal land use is for livestock grazing (cattle, sheep and goats).

##### *6.2.4.1 The Western Terrace*

This zone extends the entire length of the delta from the Primate Reserve down to the salt pans at the coast. It represents the largest continuous area of acacia/ euphorbia thicket and scrub. At its broadest point, the terrace is 8 kilometres wide, but on average it extends

5-6 kilometres (Nyunja *et al*, 2002). The western terrace forms part of a much larger continuous tract of thicket and bushland habitat extending all the way into the Tsavo East National Park. The Malindi-Garsen road is therefore an artificial division, but it conveniently marks the limits of the Delta on its south western flank.

The Northern part of the Western Terrace is sparsely populated with no distinct villages but scattered bush homes. Garsen and Idsowe are sizeable communities and Garsen in particular is growing fast. It is the administrative centre for the Tana Delta hosting the Sub-county Headquarters (the County Headquarters are at Hola). There are also schools and medical facilities. With this status, Garsen is treated as a separate sub zone for planning purposes. The town has a commercial and trading centre with banks and micro-finance institutions and a livestock market. It is also an important location for receiving and marketing local agricultural produce which is then sent by road to Mombasa, Nairobi and other centres. Garsen has its own air strip and most parts are serviced with electricity. A new power station is under construction (Pers. observation).

The central part of the Western Terrace is well served with access roads and tracks and contains a substantial number of permanent buildings including schools and private houses in Tarasaa and adjoining settlements. The southern part of the Western Terrace contains a significant number of newly emerging homesteads bordering the main road. Throughout the Western Terrace the population is rising as migrants move in from other parts of Kenya in anticipation of improving economic opportunities brought about by the development of the LAPSET corridor project. Ethnic groups include Pokomo, Giriama, Kikuyu, Kamba, Kisii, Luhya, Taita, Orma, and Wardei among others. In many cases new residents find it difficult to get established and turn to environmentally destructive forms of livelihood like firewood collection and charcoal burning (Odhengo *et al*, 2014a).

Large parts of the Western Terrace are occupied by ranches which have been in existence for over thirty years, but have generally been left in an undeveloped state. All ranches are held on leases and do not have title deeds. There are three intersecting wildlife corridors that pass across the Western Terrace linking Tsavo East with the Delta. These corridors are also used for driving livestock (Odhengo *et al*, 2014a).

##### *6.2.4.2 The Eastern Terrace*

The Eastern Terrace has the same characteristics as the western section. It is, however, more extensively developed in the north, where TARDA has sought to

develop an irrigated rice scheme over the last thirty years. The current cultivated area extends from Sailoni in the northern section, where the intake from the River Tana is located, down to the rice mill and administrative centre at Gamba, south of the Witu road. Some tourism activity takes place in the zone linked with the Ishaqbin Wetland Conservancy and the Tana River National Primate Reserve (Odhengo *et al*, 2014a).

Galole Horticulture Ltd is a private venture that is seeking to introduce cultivation in some parts of the terrace. There are two principal corridors for migratory animals, both wild and domesticated.

### 6.2.5 Coastal Belt

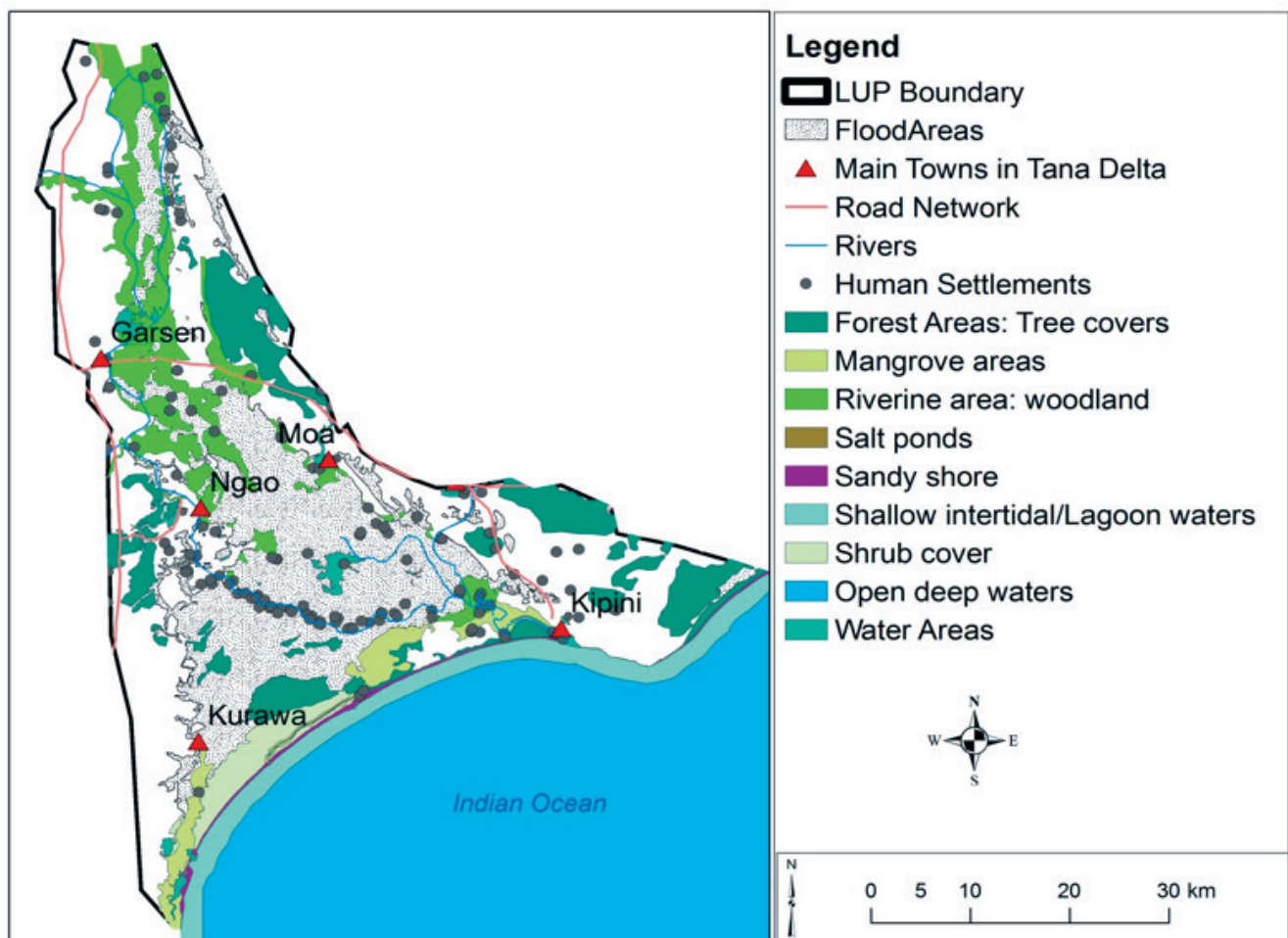
The coastline of the Tana Delta stretches 60 kilometres from the old mouth of River Tana to the current estuary at Kipini (Odhengo *et al*, 2014a). Over many thousands of years a high dune system has developed which separates the delta from the sea. The dunes are highly porous and absorb all rainwater without contributing significantly to the delta. Three breaches occur in the dunes where River Tana or its former courses enter the sea. Maritime

grasses, scrub and open areas of sand cover the seaward faces of the dunes while denser vegetation clothes the inland slopes and the lower areas are well wooded. The long expanse of sandy foreshore is a breeding area for turtles (Odhengo *et al*, 2014a).

The northern section of the Coastal Belt contains the coastal town of Kipini, which is the second largest settlement in the Tana Delta. It operates as a small fishing port and market centre for the southern delta. There are also a number of farming settlements close to the Tana/Lamu County boundary.

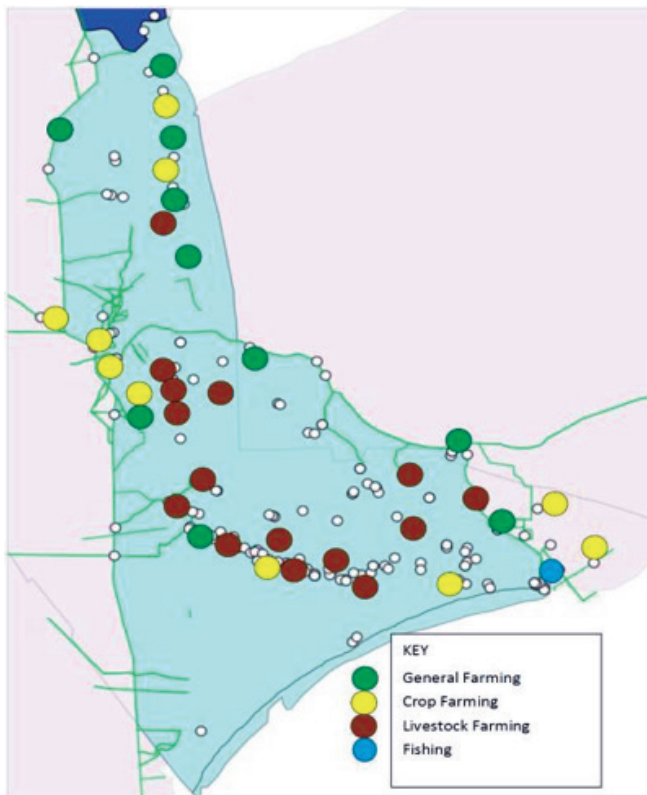
The Central part of the Coastal Belt, which extends from Kipini to Mto Tana, has no permanent habitation apart from a small eco-tourism camp and the Delta Dune Lodge. Delta Dunes Lodge/camp is privately owned and located in Ozi forest near Mto Tana. The company collaborates with the local community through the LTDCT to promote ecotourism and conservation of the Ozi and Chara area. Current levels of tourism are low due to fears over security and the low level of accommodation facilities. The Mulikani Community Conservation Group based

**Figure 6.7 Important Habitats**





**Figure 6.8 Settlements**



in Ozi have a banda with simple visitor accommodation and also have a boat that takes visitors to view hippos and crocodiles in the Mbililo/Sagema wetland. This venture has had only limited success to date due to lack of marketing, advertisement and the current size of accommodation facilities.

Management of the Coastal Belt for conservation and wildlife is important for both marine, freshwater and forest species. The dunes and beaches form part of the area administered by the Lower Tana Delta Conservation Trust (LTDCT) under the Ozi Forest Management Plan (2010). Forests and dunes provide important ecosystem services, and support economic activities including harvesting of wild fruits and the use of agro-forestry products such as coconut and mangoes.

The Coastal Belt has a number of fish landing sites including Ozi and Kipini, which are operated by Beach Management Units (BMUs) controlled by local fishermen who use canoes and dhows to catch fish in shallow inshore waters. Some local fishermen have acquired coolers and buy ice from Malindi/Mombasa. This section of coast is very exposed to storms and strong currents during the monsoon so deep water fishing is not currently feasible with the restricted gear owned by local fishers. The outer waters are, however, fished by foreign industrial trawlers, which are known to cause considerable damage to the seabed (Hamerlynck, 2012).

### 6.3 Zones with Special Features

In addition to the topographic zones, two sets of special features are defined on separate maps (see Plans 6.5 and 6.6). These features comprise: 1) Important habitats, and 2) Settlements.

### 6.4 Potential Land Uses within the Planning Zones

In order to assess what types of sustainable land use might be promoted within the Tana Delta the planning team carried out a review of all potential development activities. The inclusion of an activity in the following list does not indicate that it would automatically be a suitable form of development. This could only be determined after the full range of social, economic and environmental factors are taken into consideration as part of the detailed planning of specific developments, as discussed in Chapters 8 and 9.

#### 6.4.1 River Corridors

- Fruit farming (tropical citrus, mangoes, lemons, lime, bananas, pineapple)
- Small scale irrigation using pumps
- Vegetable production
- Wild fish capture
- Aquaculture
- Riverine forest natural resource harvesting
- Beekeeping
- Eco-tourism

#### 6.4.2 Flood Plains

- Livestock grazing
- Wild Fish capture
- Aquaculture
- Fish processing
- Large scale commercial farming - tropical citrus fruits, mango, lime, bananas, pineapple, etc
- Oil and Gas extraction
- Tourism- bird watching, boat and canoe rides, wildlife viewing e.g. hippo, buffalo, waterbuck, elephants on migration to/from Ozi Forest. In the dry season wildlife migrate to areas of the river mouth with the Indian ocean.
- Large scale commercial farming using recession cultivation combined with irrigation timed to coincide with two dry seasons annually - sugar, rice, maize, horticultural crops, green grams, beans, cow peas, water melon.
- Extracting natural chemicals for pharmaceutical industry from forest products.
- Mariculture (in coastal section) - crab farming, prawns and shrimps.
- Timber exploitation - e.g. mangrove has high value timber for building purpose

- Non-Timber Forest Products - Palms e.g. Wild Date Palm (*Phoenix reclinata*) and East African Doum Palm (*Hyphaene compressa*) used for making mats and other handicraft materials, especially by women of Chara.
- Settlement - potential for significant increase in local community housing
- Conservation and ecosystem service management
- National Park/Community Conservancy - for conservation e.g. Kon-dertu ranch on migratory route for wildlife.

#### 6.4.3 Terraces

- Large scale commercial farming: sugar, rice, maize, horticultural crops, tropical citrus fruits, mango, lime, green grams, beans, cow peas, pineapple, water melon, bananas.
- Potential industrial development at selected sites (e.g. Garsen/Tarasaa/Witu/Kipini) - meat processing, food processing, fish processing, warehousing, packaging, water filtration, medicinal plant distillation and processing.
- Business development - the major interests of the communities who are positioning themselves along the road corridor where future economic development will grow as a result of the LAPSET programme.
- Salt harvesting - southern area has potential for this through evaporation.
- Timber harvesting - at present being carried out illegally.
- Commercial farming - on the ranches. Most of the area within the ranches had been identified for commercial development (biofuels/jatropha) and had been held under lease by Bedford Biofuels and other firms.

- Forestry - potential for CFAs for managing forest pockets for agro-forestry, firewood and bee-keeping
- Murram and building sand - outlying areas have valuable deposits
- Ranches - have potential for both livestock and wildlife.
- Tourism - scope for tourism development and accommodation.

#### 6.4.4 Coastal Belt

- Titanium extraction from coastal sands
- Oil and Gas exploration both land based and offshore
- Extracting natural chemicals for pharmaceutical industry from forest products
- Aquaculture farming e.g. for prawn farming
- Significant tourism development
- Timber exploitation e.g. mangrove has high value for building and furniture.
- Non-timber forest products - Wild Date Palm and East African Doum Palm used for making mats and other handicraft materials.
- Residential development - with direct access to Malindi using the local Delta Dunes airstrip.
- Settlement - potential for significant increase in local community housing
- National Park/Community Conservancy
- Offshore fishing- potential exists for industrial fishery landed and processed in local area
- Development of a local fisheries market-e.g. for development of a thriving marine fishery with links between local fishermen and markets in Lamu
- Sports/recreational marine fisheries e.g. deep sea fishing by tourists.

**Table 6.1: Land Use Classes Found within Topographic Areas**

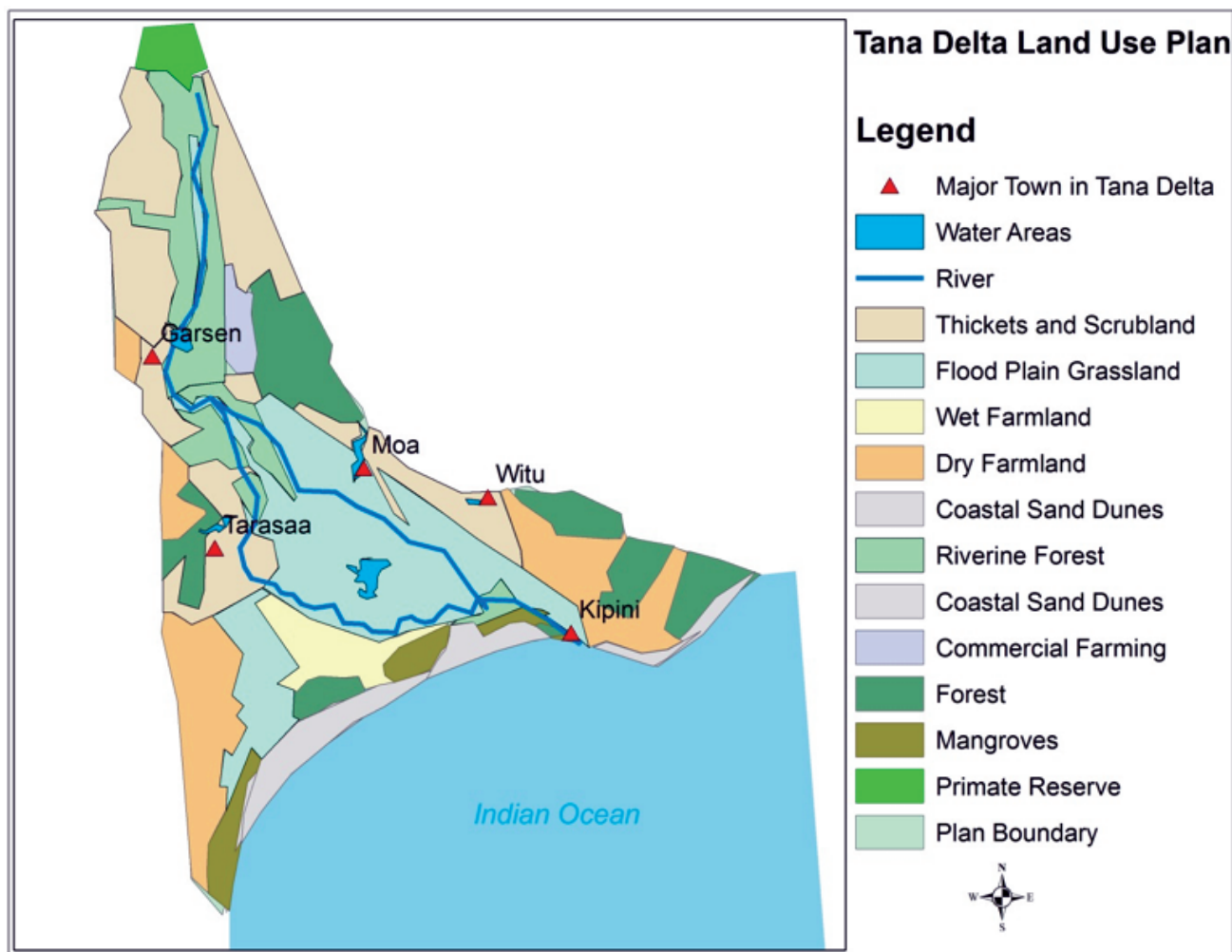
Land use class	Floodplain	Terraces	Coastal Belt
Forest	X	X	X
Riverine forest	X		
Dry thicket		X	X
Mangrove and inter-tidal areas	X		X
Dry farmland and scrub		X	
Floodplain grassland	X		
Wet farmland	X		
Dunes			X
River corridor	X		
Commercial farming		X	
Urban areas		X	X
Industrial zones		X	X
Lakes and open water	X	X	X

## 6.5 Land Use Classes

The detailed methodology set out in Chapter 15 provides a definition of 13 land use classes, which are distributed across different parts of the Delta as shown in Table 6.1 and Plan 6.7. Some land use classes are found in all topographic areas, for example forests and thicket

and scrub, but others like dunes are restricted to only one zone (Coastal Belt). The Planning Statements and Policies in this Land Use Plan have been written so that they apply to specific land use classes, cross-referenced where relevant to the topographic zones.

**Figure 6.9 Distribution of Land Classes**





# SCENARIOS FOR THE STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

## 7.1 Introduction

A series of three scenarios were developed in order to form the basis for the land use strategy which maximises the opportunities for sustainable economic development while at the same time protecting social welfare and the environment. The three scenarios are described in detail in Part 2 (Chapters 3-5) and in the separate Strategic Environmental Assessment (SEA), which has examined their performance (Odhengo *et al*, 2014a). This chapter simply provides a brief summary of the outcome.

## 7.2 Scenario A – Continued Development of Traditional Livelihoods

### 7.2.1 Description

Scenario A sets out a pattern of development in the Delta area to the year 2050, based on the assumption that the main elements of the economy will remain unaltered by focusing on subsistence agriculture and livestock rearing, fishing, bee-keeping and natural resource harvesting.

The population of the Delta is expected to rise from its present level of 102,000 people in 2010 to 175,000 people in 2030 and 315,000 people in 2050. The main form of economic activity at the present time is livestock rearing. There are approximately 220,000 head of cattle in the Delta during the wet seasons and this number increases to over 700,000 cattle during the dry season, when many animals are driven into the Delta from surrounding areas.

As an entirely theoretical exercise, an assessment was made of the number of cattle that would need to be kept throughout the year in order to maintain the current ratio of livestock to individual households based on the forecast population growth rates. The analysis indicates that there would need to be 357,000 cattle by 2030 and 645,000 cattle by 2050 in the wet as well as the dry seasons. (The potential economic value of livestock would rise from KES 2 billion in 2010 to KES 4 billion in 2030 and KES 7 billion in 2050). In reality, the SEA shows that, depending on stocking densities, an area between 1.5 and 5 times the size of the Tana Delta would be needed to grow sufficient grass to sustain this number of animals, and that the Delta is completely unsuited to keeping large numbers of livestock in the wet seasons. In practice the actual carrying capacity of the Delta will be reached in less than five years.

The second area of economic activity is subsistence farming which is practised by more than half of the

households in the Tana Delta. The amount of food produced from the average of 0.6 ha (1.5 acres) is insufficient to feed the population and up to 40% of households receive food security payments in years when the harvest is poor. In order to increase food production an additional 4,500 ha of land would need to be converted from grassland or scrub to create permanent areas of cultivation by 2030 followed by a further 8,500 hectares by 2050. The economic value of food crops produced is relatively low since there is very little output to commercial markets.

A third area of economic activity and livelihoods is based around the harvesting of natural resources for food, medicinal plants and building materials. At present more than 90% of the housing stock is constructed with mud, grass, reeds, palm leaves and poles collected from the forest areas. These natural assets have very considerable value if the building methods are compared with modern construction using concrete bricks, mortar and zinc sheeting.

### 7.2.2 Analysis

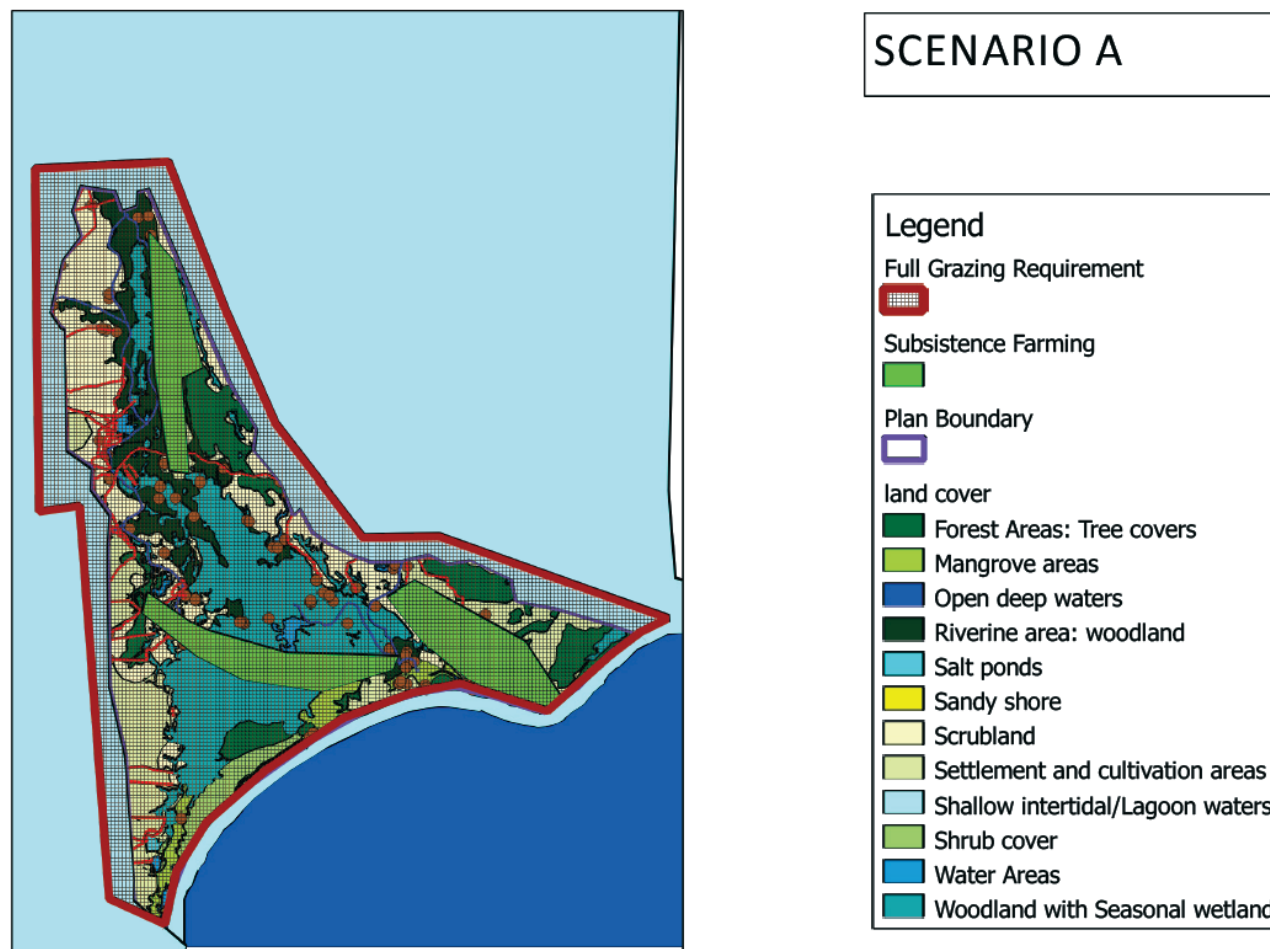
A summary of the Strategic Environmental Assessment (SEA) of Scenario A, based on six principal evaluation criteria is presented below.

**Land Areas:** The first conclusion reached in the SEA is that the continued increase in the number of cattle grazed within the Delta is physically impossible. The main areas of grassland are already overgrazed during the dry season and any increase in animal numbers would lead to permanent destruction of the grasslands. In consequence, it would be necessary for pastoralists to transfer their activities to farming - which is already happening to some extent. The increase in land required for cultivation would double the estimates allowed for in relation to existing farming communities. Conversion of large areas of land to crop production would further reduce the areas available for grazing, requiring a reduction in livestock numbers below the existing threshold.

**Water Demand:** Existing livelihood practices create a very low demand for water, apart from the need to maintain the ecological reserve. The expansion of both livestock rearing and subsistence farming would not have any significant effect on future water demand, although access to water would become a serious constraint.

**Employment and livelihoods:** It is assumed that the

**Figure 7.1 Sketch Layout of Scenario A**



(Note: The area hatched in brown shows the minimum land requirement for grazing cattle in the dry seasons by 2030 assuming no other uses are permitted within the Plan Area)

majority of people would be actively employed in farming and livestock rearing, with very few opportunities for the development of new enterprises.

**Social and Cultural Conditions:** Standards of living would remain extremely low and the majority of the population would remain below the poverty level.

**Governance and Security:** It is inevitable that existing tensions over access and control of land and water resources would increase rapidly. Prospects for peace and security would be very poor.

**Biodiversity:** Extension of livestock rearing, subsistence farming and harvesting of natural resources would have serious implications for some of the most important habitats for animals and birds, including areas of Riverine Forest, other forests, mangrove and wet grassland. There would be an overall decline in biodiversity and the Delta would lose its status as an international conservation site (IBA and Ramsar site).

## 7.3 Scenario B – A Commercial and Industrial Approach

### 7.3.1 Description

Scenario B explores the possibilities of developing a commercially oriented approach to land use in the Tana Delta. The same growth rates in terms of population are maintained, as set out in Scenario A, and the assumption is made that new forms of economic activity will provide employment and income to allow a substantial number of households to move away from subsistence farming and livestock rearing.

A wide range of economic activities are considered, including commercial ranching of cattle, other livestock and wildlife, commercial and irrigated farming, production of industrial crops like sugarcane, the development of factory processing, mining and tourism. This model requires conversion of large areas of natural habitat to farmland, infrastructure and industrial zones among others. The economic returns, assuming that all forms of

activity are compatible, are very substantial, being four times greater than the economic output from Scenario A. An indicative layout of major land uses is shown in **Figure 7.2**. It should be noted that a number of land uses are in direct competition with each other – for example livestock rearing and industrial crop production.

### 7.3.2 Analysis

An assessment of Scenario B based on the evaluation criteria is presented below.

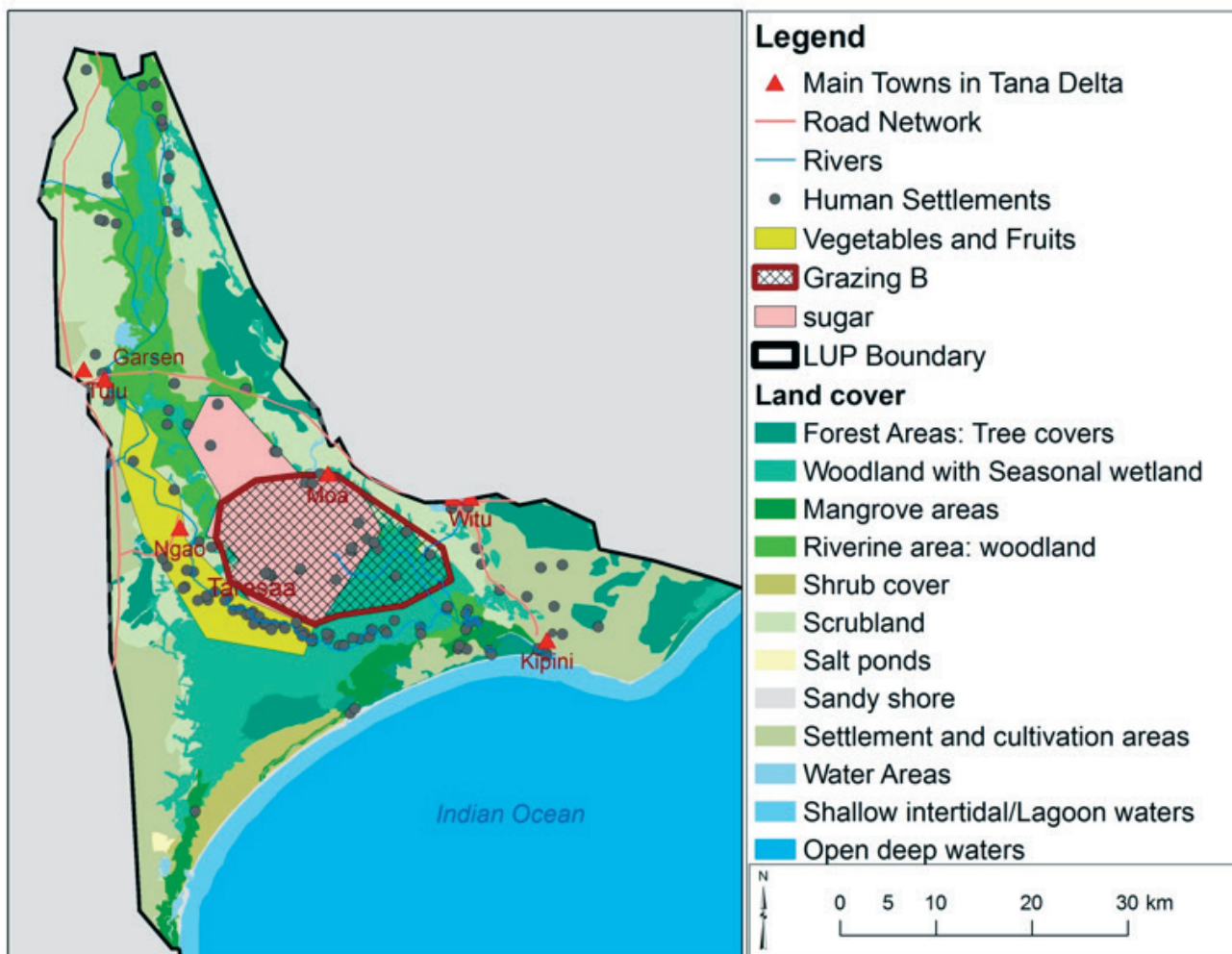
**Land Areas:** The amount of land needed for commercial purposes crop farming by 2030 is 20,750 ha increasing to 41,500 ha by 2050. 25,000 ha will be needed for fattening commercial livestock by 2050. If implemented, the ecological functions and traditional system of the indigenous people would be seriously disrupted.

**Water Demand:** A very large increase in demand for water would arise. Up to 10 m<sup>3</sup>/sec (raising the total water demand to 117% of the current mean daily flow

in the River Tana of 60m<sup>3</sup>/sec) would be required by 2030 and more than 20m<sup>3</sup>/sec (133% of the mean daily flow) would need to be abstracted by 2050. Almost all of this demand would be generated by rice and sugarcane plantations. This assumes that current flow levels in the River Tana can be maintained over this timespan. Desalination of water for irrigation is a possibility but has technical and financial challenges.

**Employment and Livelihoods:** 25,375 jobs would be created, especially in relation to industrial crop production, mining, manufacturing and service industries. However, these gains would need to be offset against loss of livelihoods due to disruption of traditional livelihood systems and the resulting economic impacts. For example, livelihoods depending on selling milk and livestock products and subsistence farming could be more sustainable than those that are dependent on low wages of local people working as cane cutters at minimum government wages.

**Figure 7.2 Plan Showing Indicative Land Uses under Scenario B**



**Social and Cultural Conditions:** The development of a skilled labour force and improved economic conditions could lead to improvements of education, enhanced social amenities, and reduced fertility rates which in turn would translate to higher standards of living for some people. However, a potentially divisive split would be created between those who were beneficiaries of a regular income from paid employment and those who were displaced from their existing land holdings. The scale of change needed to accommodate the new land uses would be very disruptive.

**Governance and Security:** Existing tensions over land and water would be exacerbated and new challenges would arise from the need for widespread resettlement of existing communities. The demands for water to support large scale irrigation would have serious impacts on all other water users. It is highly unlikely that the package of development options would be acceptable to any of the communities (either pastoralists or farmers) and major conflict would result between prospective developers and the resident population.

**Biodiversity:** Transformation of land and existing habitats within the core area of the Delta to commercial and industrial farming would destroy the ecosystem integrity of the Tana Delta Ramsar site.

## 7.4 Scenario C – The Hybrid

### 7.4.1 Description

**Scenario C** starts to explore the options that exist between an intensive commercial approach to future land use in the Delta and a continuation of existing livelihood practices. It takes as its main assumption the need to maintain a balance between agriculture and livestock rearing, with both uses being restricted to an area of 65,000 hectares each (130,000 hectares in total) representing just under 60% of the total land area in the Delta. The balance of 95,000 ha (40%) would be retained to serve all other uses, including urban development, new industrial development and primary nature conservation zones like riverine forests, forests, mangrove and the coastal dunes and beaches. The areas of land providing natural resources and ecosystem services would be substantially greater than the 95,000 ha, since much of the land used for cattle grazing would remain as wet grassland within the floodplain.

This Scenario takes a more selective approach to the range of crops to be grown, placing emphasis on intensive and extensive vegetable production, rice farming, and fruit growing under both individual and communal/private partnership joint ventures. The choice reflects the suitability of the Delta for particular

types of crop, known market demand, high labour inputs and modest to high water demand. A substantial area of rice production is allowed for on the existing TARDA cropping area in the Upper Delta with smaller patches in the Lower Delta, given the value of rice as a staple food and the scope to enhance yields through seed selection and better farming practice.

The Scenario also recognises the value of the **Scenario B** model in seeking to promote value- manufacturing operations on industrial sites, to be created in four centres within the Delta. The main focus of livestock rearing and farming activities is shown in **Figure 7.3**.

### 7.4.2 Analysis

**Land Areas:** Under this Scenario there would be a reduction in the overall area of land available for livestock grazing (given that almost the entire Delta is currently open to some degree of grazing). The loss of grazing would be compensated for by introducing a commercially oriented community ranching scheme which would be designed to fatten cattle for six months before slaughter and to process meat before shipment to local and external markets, thus raising livestock values by more than 20%. Traditional open grazing would continue in some areas of thicket and scrub for perhaps 5-10 years but would be progressively phased out as more efficient farming and livestock rearing practices are introduced.

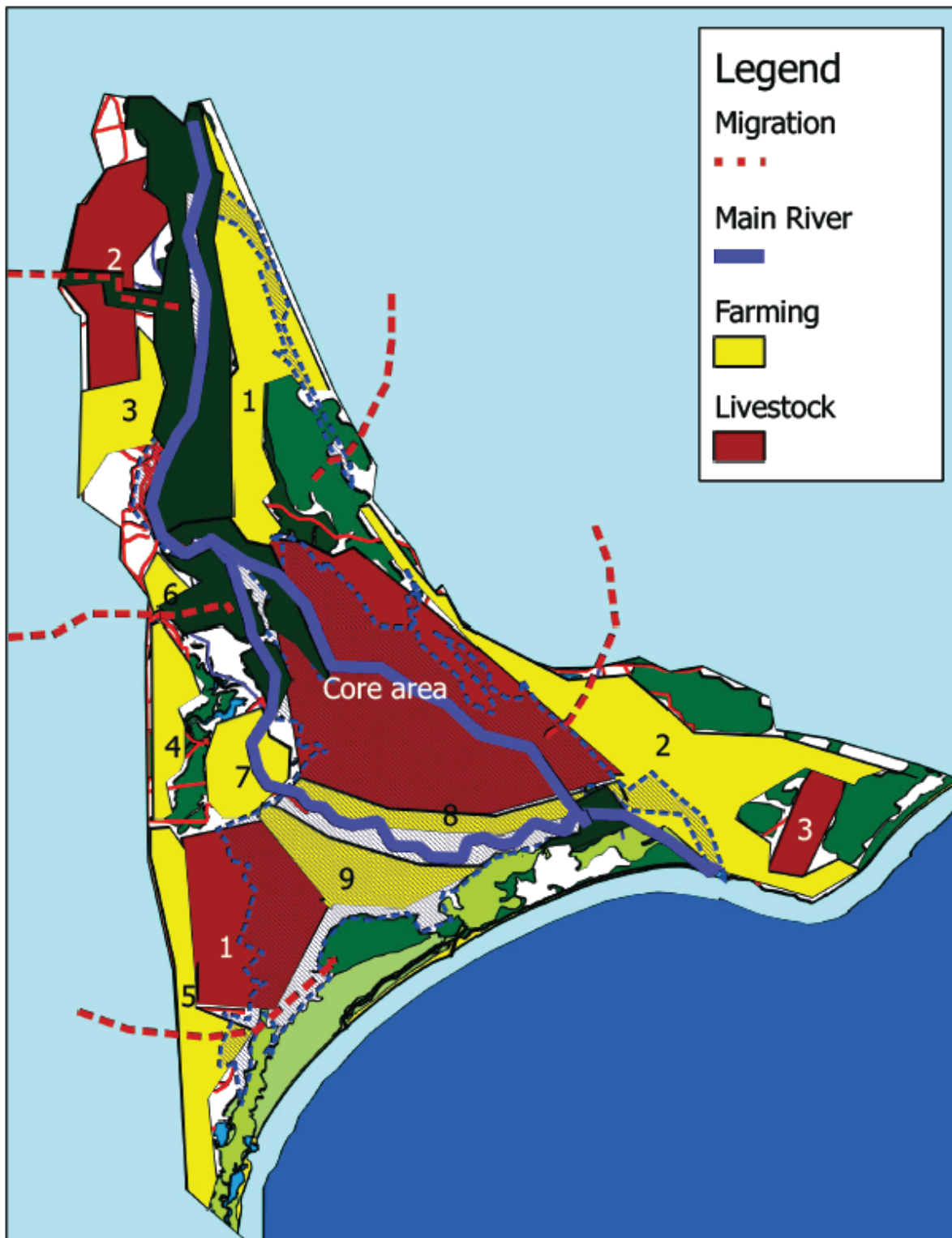
Areas under both subsistence farming and commercial agriculture would be increased significantly by converting areas of dryland thicket and scrub and small areas of wetland grassland. Land would also be set aside for industrial development and urban expansion.

**Water Demand:** The careful selection of a range of high yielding and high value crops which have only modest water demands (averaging in the range 400-700mm uptake in the growing season) results in an overall level of demand of 4m<sup>3</sup>/sec (amounting to a total of 107% of the current Tana River mean flow) and is comparable to the amount of water required under the traditional livelihoods approach in **Scenario A**.

**Employment and Livelihoods:** By 2030 about 66,350 jobs would be created, increasing to 107,260 jobs by 2050, especially in relation to crop and livestock production, mining, infrastructure, manufacturing and service industries. The labour intensive nature of vegetable and fruit production, packaging and marketing would create higher levels of employment than industrial cropping under Scenario B, with a much lower rate of displacement of existing livelihoods. In most cases, existing households would be able to transfer directly



**Figure 7.3 Plan Showing the Main Focus of Activities under Scenario C**



into the new farming structures. In any event, a large area of land would continue to be set aside for subsistence and household agriculture.

**Social and Cultural Conditions:** It is clear that all future land use scenarios within the Delta will involve considerable change and transformation, driven as much by population growth and internal changes in society as by outside pressures. These changes will need to be planned and handled with great care and skill by the two County Governments and by the communities themselves.

**Governance and Security:** **Scenario C** is not immune from risk of social unrest but it offers a more gradual and more inclusive approach and provides all sectors of society with opportunities for livelihoods and generating real incomes. This is a hybrid between the options in **Scenario A** and **B** that entail tradeoffs and accommodation of the various competing interests thereby minimising potential conflict over resources.

**Biodiversity:** **Scenario C** safeguards all key habitats and creates the opportunity for developing an ecotourism sector and substantial income generation from nature conservation and ecosystem services. Future development could include extraction and sale

of medicinal and essential oils, gums, resins or other nature-based products, together with the establishment of acacia plantations for sustainable charcoal production.

## 7.5 Conclusions and Recommendations

The three scenarios examined in the land use planning studies (see Part 2) and Strategic Environmental Assessment are all notional concepts which are intended to serve only as points of reference in exploring how the Tana Delta might develop over the next 20 to 40 years. The exercise has highlighted the fact that change is inevitable and that there are many complex factors which have a bearing on the ultimate outcomes. It has also shown clearly that some issues have greater influence than others and the future availability of water and land lie at the top of the list.

The Scenarios have informed the development of the Land Use Strategy which appears in the next Chapter and confirms how the County Governments and National Government Agencies will work together with all communities in the Delta to formulate individual projects and develop specific community-based plans and initiatives. From the analysis of the three options and approach based on **Scenario C** (the hybrid) is recommended as it is an optimal mix of scenario A and B.



### 8.1 Introduction

This chapter sets out the broad strategy which will be followed in allocating land for different uses and also ensuring that all forms of development within the Tana Delta Plan Area are fully sustainable. The formulation of the land use strategy is based on Scenario C. The Strategy forms only one component of the Plan and must be read in conjunction with national and county government policies, standards and guidelines.

The land use strategy consists of the following sections:

- Methodology and development framework
- Hierarchy of Planning Statements
- Overarching Planning Statements relating to Upper Delta
- Overarching Planning Statements relating to Lower Delta
- Planning Statements relating to land use class
- Planning Statements and Regulations relating to economic activity
- Response to climate change

### 8.2 Methodology and Development Framework

A number of principles have been used in developing the Land Use Plan in addition to those set out in guiding principles (see Chapter 3). These are listed below:

1. It is assumed that development in the Delta will consist of a combination of traditional livelihoods and commercial activities which meet sustainable criteria;
2. Anticipated growth in population will be monitored and managed by the County Governments with the aim of encouraging a progressive reduction in the birth rate beyond 2020, and a reduction in the numbers of people migrating into the Delta area;
3. All land and water use within the Delta will be regulated to ensure that the total annual demand for water does not exceed the equivalent of 60m<sup>3</sup> per second (the current mean flow of the Tana River) or 1.9 billion m<sup>3</sup> in total over the year;
4. Priority for water and land use will be given to land use and water abstraction approved activities, which are promoted and formally registered by local communities with the Governments of Tana and Lamu Counties by 31 December, 2015.

5. Government agency and private sector users will also be required to submit details of their land holdings and existing water demands for registration and approval by the County Governments within the same time scale i.e. by 31 December 2015.
6. All development will be carried out within the environmental limits/carrying capacity of the Delta in accordance with the Ramsar Convention principles of conservation and wise-use;
7. Development will maximise efficiency of use of land in the Delta;
8. After 1 January 2016 all proposals for new or modified forms of land use and associated demands for water will need to be submitted with a formal application for planning permission to the relevant County Government, who will assess the merits of the proposal against the cumulative demand for water and available surplus for extraction.
9. The County Governments may refuse, or direct that modifications are made to the type of use, area of land or amount of water to be used, based on their technical assessment of the project's impacts on land and water availability, the economy, social conditions and the environment;
10. A systematic process has been adopted for identifying land and water areas which require special attention within the Land Use Plan. These include gazetted areas, areas formally designated in the Plan and those areas that are subject to regular seasonal flooding by water from River Tana.

#### 8.2.1 Identifying Gazetted, Designated and Floodplain Areas

The initial allocation of land and water uses in the Tana Delta land use strategy has been made by identifying:

1. All areas where there are clearly established environmental and/ or social safeguards which are legally gazetted. These include forest reserves and river corridors.
2. Existing settlements and designated communal land holdings around those settlements.
3. The core area of the floodplain in the Upper and Lower Delta.

Chapter 9 of the Plan contains references to the specific laws and regulations affecting land use within each of the gazetted and designated areas.

### 8.2.2 Development Framework

Four critical elements determine the nature of the development framework; these are:

- availability of water,
- availability of land,
- development of urban areas, and
- relationship between development sites and gazetted and designated areas.

#### 8.2.2.1 Availability of Water

The future of the Tana Delta and its communities depends upon maintaining minimum flows in the River Tana. Detailed hydrological studies are required in order to determine the precise range within which river flows should fluctuate but the initial assessment set out in the SEA indicates that the mean flow should not fall below 60 m<sup>3</sup> per second except in extreme drought conditions (Odhengo *et al*, 2014a).

Examination of different scenarios for future land use suggests that an increase in demand for water within the Tana Delta of up to 10 m<sup>3</sup> per second over and above the mean flow of 60 m<sup>3</sup> per second could be accommodated, provided a regulating reservoir is built, in conjunction with the proposed High Grand Falls Dam, to provide the necessary storage. This regulating reservoir is essential to provide for future irrigation and water supply for domestic and commercial purposes in the lower River Tana basin and adjacent development associated with Lamu port.

The purpose of the regulating reservoir is to capture water released on a daily basis as a result of electrical power generation from the High Grand Falls Dam, and to store this water for subsequent use in irrigation, public water supply and regulation of the river flow. The role of this reservoir is crucial since none of the land use development proposals set out in this Land Use Plan could be developed successfully without it.

As time passes, availability of water will become an increasing constraint on all forms of development, so it is essential that land uses are promoted within the Tana Delta which maximise water conservation and its wise use. This has led to the selection of land uses that exhibit the most efficient types of water use. These include intensive vegetable production, using spray and drip feed irrigation rather than open ditches and gravity systems. The only exception to this principle relates to the growing of rice, which requires the formation of temporary flooded paddy fields. Rice has a very high nutrient content and can serve a very useful function in feeding the Delta's population. It can also be grown on land which is naturally flooded by the River Tana.

Large-scale irrigation for industrial crops like sugar is not practical within the Tana Delta for a number of reasons. The most important relates to the high annual demand for water. Research conducted as part of this Land Use Plan preparation has shown that 20,000 ha of land can be more effectively used with lower water intake for food production than for any other form of commercial cropping. The second consideration concerns the need to ensure that the River Tana continues to migrate naturally across the floodplain in order to maintain the integrity of the Tana Delta and sustain the fertility and biodiversity of the floodplain. An important principle in this Land Use Plan is that no engineering works should be undertaken which would prejudice the maintenance of the natural hydrological system and large-scale irrigation projects would conflict with this objective. A third reason for resisting proposals for large scale mono-culture like sugar cane is the inevitable need for widespread resettlement of communities with up to 25,000 people involved. Finally, the creation of monoculture cropping regimes would largely destroy the special environmental qualities of this internationally important conservation site.

#### 8.2.2.2 Availability of Land

The area of the Tana Delta is finite and its capacity to accommodate land use change is constrained by the need to meet the principal requirements of its two main communities for livestock grazing and farming. Following careful assessment of the options, the land use strategy determines that an equal amount of land should be retained for both purposes; that is 65,000 ha for livestock and 65,000 ha for agriculture. These are not exclusive uses, and in both livestock and agricultural areas other essential uses will continue including management of the floodplain for nature conservation, the production of natural resources and tourism activity. The balance of 95,000 ha represents protected areas, urban development sites and infrastructure.

#### 8.2.2.3 Residential and Commercial Development

During the 16 year Plan period which extends to 2030, significant changes will occur within the Tana Delta. One of the most important will be the expansion and improvement of both urban and rural areas in order to accommodate increases in population and improvements in standards of living. The location of towns and villages which are selected for expansion must be carefully chosen in order to maximise the value and efficiency of investment in new public and private buildings and infrastructure. In addition, settlements which are to be enlarged should be situated on higher ground to avoid the risks of flooding.

**Settlement hierarchy:** A hierarchy of settlements will be developed, distinguishing between urban and rural communities. In terms of urban locations **Garsen** will be the sub regional centre. **Witu** and **Tarasaa** will form local centres, while **Kipini** will act as a sub centre.

A detailed **urban development plan** will be produced for each of the four settlements in the next five years.

Other rural settlements will be the subject of **rural development plans**.

#### 8.2.2.4 Relationship between Development Sites and Gazetted and Designated Areas

Proposals for development within the Delta cannot be considered in isolation, given the intricate relationships between human activity and the natural environment. A change of land use in any one area will have ramifications for adjacent zones and the Plan emphasises the need to consider indirect effects arising from any development proposal on the rest of the Tana Delta and particularly settlements and gazetted and designated areas.

### 8.3 Hierarchy of Planning Statements

Planning Statements identified by number and 'quotation marks' are carefully drafted, have the full weight of law (see Box 8.1) and shall be relied on by the authorities in decision-making and any legal procedures. The promotion of sustainable development, encouragement of innovative projects and control and regulation of land use within the Plan Area will be guided by four inter-linked and over-arching sets of Planning Statements. The first two sets of statements relate specifically to the Upper and Lower Delta and deal with area based policies. The third set provides guidance on all issues relating to

individual land use classes (e.g. the types of activity that may be encouraged within wet farmland). The final set pick up the theme of individual economic activities which may be promoted in more than one geographic area and within different land use classes (e.g. the introduction of irrigated agriculture). In most cases more than one set of Planning Statements will be relevant when considering particular development options.

### 8.4 Overarching Planning Statements relating to Upper Delta (UD)

**Floodplain** - Parts of the upper Tana Delta are of a lower level of importance for biodiversity than the core floodplain in the Lower Delta. This is due to the historical development of the TARDA Integrated Rice Project which has largely transformed a former key floodplain area into a managed agricultural scheme. Nevertheless the upper delta is critically important in providing a linking corridor between the Tana River Primate Reserve and riverine forests which extend throughout the upper delta and connect to similar habitats in the lower delta. The upper delta also plays an important, but largely un-researched, role in storing flood water and then releasing this to the lower delta.

**Statement UD1** 'Any development proposal which would reduce or vary the amount of water reaching the Lower Delta will be refused planning permission'.

**Statement UD2** 'Proposals for reforesting sections of the upper delta using natural and endemic species will be encouraged, especially where this will help to retain and strengthen existing riverine forest.'

#### BOX 8.1 Legal Status of Planning Statements

Planning Statements in this Land Use Plan have been drafted to give effect to Part X1 'County Planning' of the County Governments Act, 2012. All references to planning in the said Act are relevant, but Planning Statements are specifically designed to satisfy the obligations on the County Councils for preparing ten year county GIS based database system spatial plans (S 110). These obligations include but are not limited to providing:

- a. a spatial depiction of the social and economic development programme of the county as articulated in the integrated county development plan,
- b. clear statements of how the spatial plan is linked to the regional, national and other county plans; and
- c. clear clarifications on the anticipated sustainable development outcomes of the spatial plan.

(2) the spatial plan, which shall be spatial development framework for the county, shall:-

- a. give effect to the principles and objects contained in sections 102 and 103;
- b. set out objectives that reflect the desired spatial form of the county taking into account the development programme of the county as articulated in its county integrated development plan;
- c. contain strategies and policies regarding the manner in which the objectives referred to in paragraph (b) are to be put into effect.

This is an abbreviated summary of key passages in the Act.

**The Terraces** - The upper delta has also experienced a considerable amount of subsistence farming associated with groups of villages located on the edge of the floodplain and adjacent terraces. The upper delta terraces offer the potential for further community-based agricultural development, as well as other livelihoods. Given the long term implications of climate change, which will include increased saline intrusion into existing wetland farming areas in the lower delta, priority will be given to locating new communal/PPP farming initiatives in the upper delta.

**Statement UD3** 'Strong emphasis will be placed on projects leading to greater involvement of local communities in farming activity. Conversely, any agricultural or industrial cropping proposals that reduce involvement of local communities and local employment will be strongly resisted'.

The development of an Integrated Water and Land Management Action Plan for the upper delta is a key recommendation of the land use strategy. There is potential for further renovation and improvement to the existing irrigation scheme with particular emphasis on the role of individual farmers and community-based initiatives.

## 8.5 Overarching Planning Statements relating to Lower Delta

**Floodplain** - The lower delta contains the largest area of relatively undisturbed floodplain, although key habitats and land uses within this area have been adversely affected by changes in river regime and flood patterns and also by excessive grazing. The same area is of critical importance in maintaining traditional livelihoods and culture, including livestock rearing, natural resource harvesting and fishing. For clarity, overarching statements have been assigned the abbreviation LD standing for Land Development.

**Statement LD1** 'Every effort will be made to promote existing traditional uses of the floodplain. No land use changes will be permitted which would lead to a reduction in the value and importance of the Tana Delta's status as an internationally important Wetland'.

The area lying between the two main channels of River Tana extending from the junction of the Matomba Brook to the confluence upstream of Kipini forms the true heart of the Delta and the maintenance, improvement and sustainable use of this area has the highest priority in terms of the objectives in the land use strategy. This area is largely used as a dry season grazing refuge and flood recession crop farming.

**Statement LD2** 'The central part of the floodplain will be maintained in perpetuity as a grazing area for livestock and wildlife'.

The upper part of the floodplain is less exposed to salt water intrusion than the lower parts around Hippo Lake, and a part below Gamba / Walkon has been degraded by previous attempts to introduce irrigation development.

**Statement LD3** 'The area previously physically affected by the failed TARDA Integrated Development project will be considered for future communal/PPP farming initiatives, subject to detailed feasibility studies to confirm that the soil conditions and hydrological regime can be managed successfully'.

For the avoidance of doubt, Statement LD3 refers only to land actually damaged by previous construction and land grading activity. It does not apply to the bulk of land formerly considered as part of a potential sugarcane plantation.

**River Corridor** - Sections of the Lower Delta include the river corridors and extensive areas of wetland farming, particularly to the south-west of the former main channel of River Tana. This corridor also contains a dense network of settlements with Pokomo villages lying to the south and Orma settlements lying on the northern bank.

**Statement LD4** 'Proposals for reforesting sections of the lower delta using natural and endemic species will be encouraged, especially where this will help to retain and strengthen existing riverine forest'.

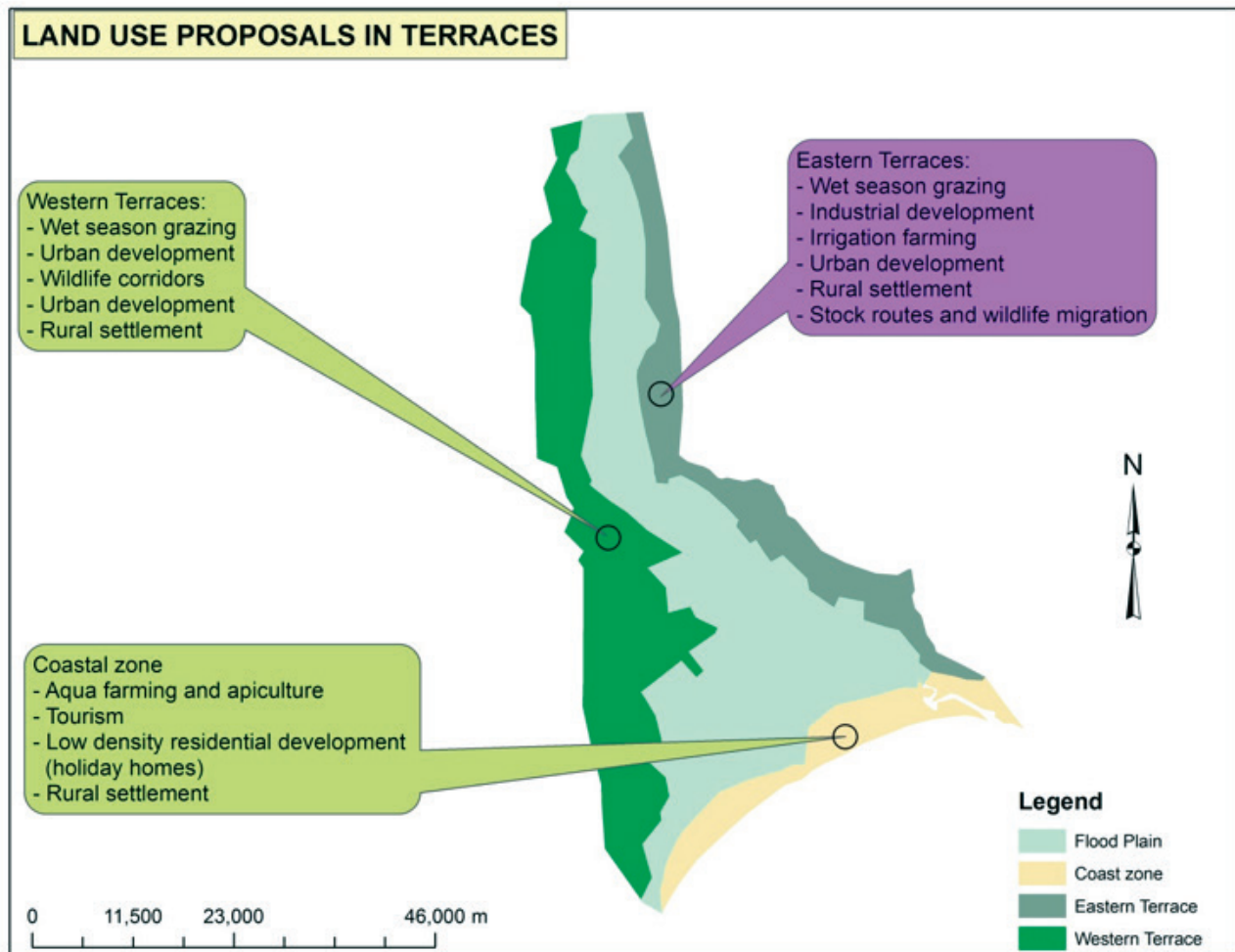
**Statement LD5** 'Particular attention will be given to the preparation of rural development plans for all of the key villages in the Lower Delta in order to help resolve areas of uncertainty over land rights, access to water and land management'.

**The Terraces** - The land on both sides of the floodplain rises to form terraces, which are increasingly being developed for subsistence agriculture by inward migrants. Much of this development is of a random nature, which needs to be controlled in order to optimise future land use. Most of the terrace areas will need to be converted to other uses, including dryland farming, small areas of grazing and settlement growth, including location of industrial sites.

**Statement LD6** 'A full land use survey will be undertaken for the terraces to inform detailed planning and development in these areas. Following completion of the survey an action plan will be prepared to steer all future development in these areas'.



**Figure 8.1 Land Use Proposals in the Terraces**



## 8.6 Planning Statements Relating to Land Use Class

Plan 6.7 in Chapter 6 shows the distribution of land use classes throughout the Delta. Each land use class is subject to its own series of planning statements.

### 8.6.1 Floodplain Grassland (FG)

Existing areas of floodplain grassland form one of the most important resources of the Tana Delta in terms of nature conservation and livelihoods.

**Statement FG1** 'The only acceptable uses of these areas will consist of livestock grazing, nature conservation, eco-tourism, natural resource harvesting and seasonal agriculture in some specially designated areas'.

**Statement FG2** 'There will be a strong presumption against large scale conversion of floodplain grassland to other uses, except in the area between the Matomba Brook and Garsen-Witu Road'.

**Statement FG3** 'There will be a strong presumption against granting approval for any development which adversely affects any of the special features found within the flood plain zones'.

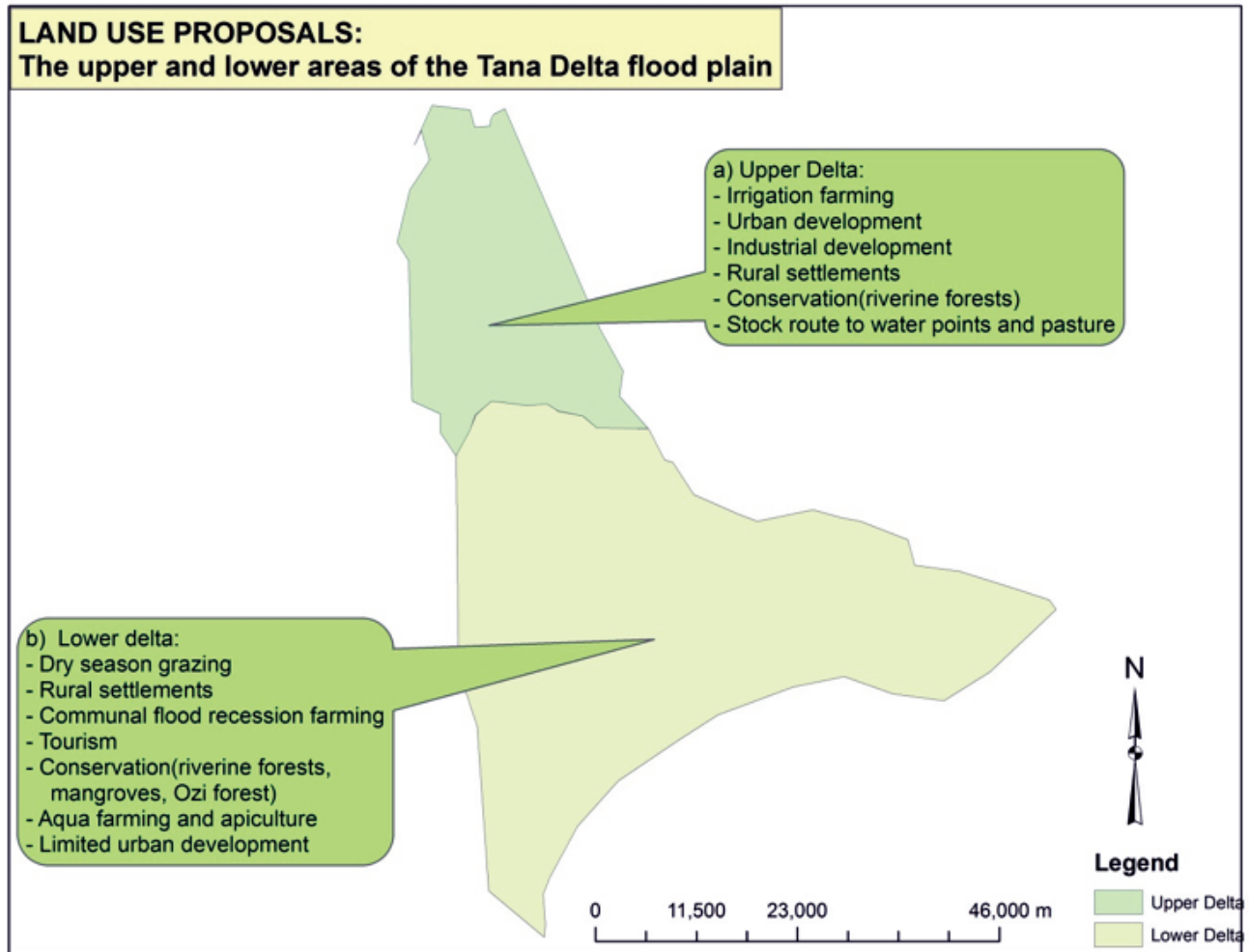
### 8.6.2 Wetland Farming Areas (WF)

A full survey will be conducted in the areas zoned for wetland farming during the first 5 years of the Tana Delta Land Use Plan, and the boundaries will be subject to revision thereafter. The survey will confirm the extent of all land that is currently being farmed by communities and individuals.

**Statement WF1** 'All types of cultivation may be practiced within wetland farming areas where these rely on groundwater or natural rainfall as the source of water supply, providing that no more than 500 ha is managed as a single entity by an individual, company or corporate body without prior approval of the County Government'. There is a very wide variety of crops which are suitable for growing within the wetland farming areas, as



**Figure 8.2 Planning Statements in the Upper and Lower Delta**



identified in Box 8.1, and the county government agricultural extension officers will assist communities and individuals to develop the potential of these farming areas to the maximum extent possible.

Due to the constraints on availability of water the development of irrigation within wetland farming areas (and other farming areas in the Delta) will be carefully regulated by WRMA and the County authorities.

**Statement WF2** 'All farmers wishing to extract water from the River Tana using mechanical pumps are required to obtain a licence from (WRMA/County) on an annual basis.'

There will be no restriction on the granting of licences for mobile pumps providing that the cumulative effect of water abstraction does not impact adversely on the communities and the environment of the Tana Delta. Proposals for the use of fixed mechanical pumps will be assessed on their merits (see section 8.7.2 on irrigation).

### 8.6.3 Dryland farming areas (DF)

The dryland farming areas of the Delta are found principally within the buffer zone and on the raised terraces above the floodplain. There is no clear distinction on the ground between areas which are identified for dryland farming and those which are intended to remain as thicket and scrub. However it is important that some areas of thicket and scrub are retained for nature conservation purposes and to act as migratory corridors for wildlife.

At present, development within the dryland farming areas is taking place on a random basis with minimal control over the allocation of land. Individual families stake their claim to an area of land by clearing the bush and cultivating smallholdings. This random development threatens the long-term value of the land for managed agricultural cultivation which is designed specifically to increase production and feed the wider community.

Since all of the floodplain is already allocated either for grazing and nature conservation or for wetland farming, future expansion of agriculture will need to take place within the dryland farming areas.

**Statement DF1** ‘The County Governments will actively support proposals for agricultural development that are situated in the most promising locations lying within or adjacent to lagas and depressions where water can be stored in the wet season either in natural lakes or through construction of water retention dams’.

There are also some limited areas of level ground where it would be possible to introduce irrigation subject to technical feasibility studies being carried out to ensure water availability and the capacity to return surplus run-off directly to the River Tana.

Farming within the dryland areas is restricted at present to rain fed cropping with a maximum of two crops a year. Quick growing varieties of maize and vegetables are required because crops may fail if their growth is delayed into the dry seasons.

#### 8.6.4 River Corridors (RC)

The banks of the River Tana have always been the preferred location for developing settlements and cultivating land. This is because the river banks are raised through the deposition of silt during periods of flooding to create natural levees. The raised banks have historically provided excellent areas for growing fruit trees like mangoes and bananas. In addition, while settlements are affected by flooding, the water remains shallow as it flows from the river into the lower wetlands of the floodplain.

Existing policies are strengthened in this Land Use Plan by extending the protected zone along River corridors to 500 m.

**Statement RC1** ‘All development (other than construction of a private dwelling house and use of land as a garden

for home food production) within the River corridors will be subject to approval by the respective county governments’.

A survey will be undertaken along all riverbanks forming part of the two main channels of the River Tana to identify locations used by livestock for access to drinking water. Appropriate locations will be agreed between pastoralists and farming communities and these will be designated as livestock drinking areas.

**Statement RC2** ‘Following survey and designation of appropriate sections of riverbank, livestock herders will be restricted to using only approved watering areas’.

The diversion of 60% of the River Tana flow into the Matomba Brook has left many villages and traditional wetland farming areas along the former course of the main river, without adequate water. However, any attempt to re-engineer the river and direct the flow to the former main channel is likely to be thwarted by future natural changes in river course. Consequently it is recommended that new communal and/or PPP farming initiatives should be directed to those parts of the Delta where conditions are most stable. These include the terraces and higher parts of the floodplain, close to Idsowe Bridge.

#### 8.6.5 Riverine Forests (RF)

Riverine forests are amongst the most sensitive and important habitats within the Tana Delta. Endemic species like the Tana River Red Colobus and the Tana River Mangabey are found only within a small number of existing forest patches which also host other threatened species of plants and animals. While collection of fruits, herbs, medicinal plants and other non-timber forest products is acceptable on a modest scale, extensive harvesting of palm leaves, timber, grass and reeds could ultimately destroy these habitats. The forests also assist in maintaining the flow of the river towards a specified direction without diverting its course. In consultation

### BOX 8.2 Range of Crops suitable for Cultivation in the Tana Delta Wetland Farming Areas

#### Vegetables/Cereals:

Rice  
Maize  
Sugar cane (for food use)  
Pigeon Peas  
Green Grams  
Tomatoes  
Peppers  
Chillies  
Lettuce  
Cucumbers

#### Fruits:

Mangoes  
Bananas  
Oranges  
Lemons  
Limes  
Passion fruit  
Melons  
Watermelons

with local communities, management plans will therefore be prepared by the Kenya Forest Service, Kenya Wildlife Service and other conservation agencies for each of the individual forests and arrangements will be made for these sites to be surveyed and monitored on a regular basis.

**Statement RF1** 'The County Governments and Government conservation agencies will actively support measures and proposals for managing existing riverine forests and any plans for extending forest areas by new planting of indigenous species.'

#### 8.6.6 Dry Forests (DF)

Within the Tana Delta there are a number of other forests which have high conservation value as well as timber and natural resource values. Some of these forests are gazetted while others are managed by communities for conservation.

**Statement DF1** 'All forests within the Tana Delta will be surveyed and positive plans and proposals will be developed by the County governments, Kenya Forest Service and local communities for their enhancement and increased nature conservation value.'

#### 8.6.7 Mangrove (M)

Mangrove forest is restricted to the coastal zone and the intertidal zone. The dense network of trunks and roots provides resistance to wave action and storm surges from the sea thus reducing the impact of coastal flooding and erosion. Mangrove also provides nursery areas for shellfish, shrimps and prawns and some marine fish species together with roosting and feeding areas for birds and insects.

**Statement M1** 'Under the Tana Delta Land Use Plan, mangrove forests will be fully protected against inappropriate development. Programmes for sustainable use of natural resources will be developed between the County authorities, Kenya Forest Service and individual communities and conservation trusts. These programmes will determine the scope for sustainable harvesting of poles and other resources for use by local communities.'

#### 8.6.8 Dunes and Coastal Beaches

The coastal beaches and dunes are important for fish landing, fresh water storage, nature conservation (including turtle nesting) and tourism.

**Statement DC1** 'Dunes and Beaches will be protected from inappropriate development which could damage their special environmental qualities and their long-term potential for ecotourism development.'

**Statement DC2** 'All forms of development in the coastal zone will require a full environmental impact assessment before being considered for approval'.

Notwithstanding restrictions on inappropriate development, the coastline offers a major opportunity for creating a single tourism site of exceptional quality and built to the highest international standards. Any developer wishing to explore the possibility of investing in such an enterprise should contact the relevant County authority for detailed discussions before commencing with any detailed feasibility studies.

#### 8.6.9 Commercial Farming Areas (CF)

The existing area of the TARDA-managed Tana Delta Integrated Project (TDIP) should be brought into full production by allocating the land to individual community farming enterprises. This area should also be extended to include the land formerly affected by the failed engineering works between the Garsen-Witu road and the Matomba Brook.

**Statement CF1** 'All proposals for commercial farming, including land within the TDIP, shall be subject to completion of full technical and environmental assessments before applications for development are considered by the respective County Government'.

#### 8.6.10 Settlement Areas

The four main urban areas will be subject to a detailed survey to identify all existing buildings, vacant areas and the layout of essential services including roads and electricity.

**Statement S1** 'All existing plans for future growth within the urban areas will be reviewed in the light of the Land Use Plan and SEA findings and will be incorporated into new Urban Development plans, to be produced within the first five year programme of the LUP'.

**Statement S2** 'Rural Development Plans will be prepared within the first five years of the LUP for all permanent rural villages (See **Figure 8.1**). A permanent village is one which has been in existence for more than ten years and is not affected by annual flooding from the River Tana'.

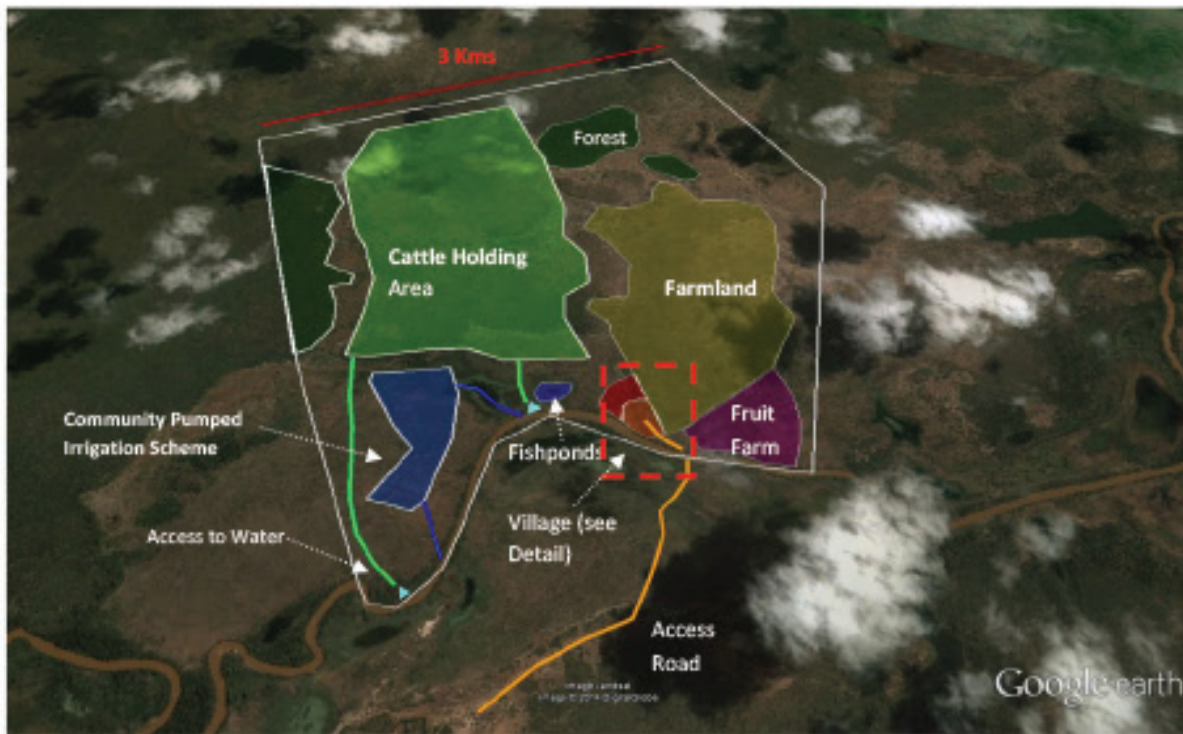
#### 8.6.11 Industrial Zones (IZ)

**Statement IZ1** 'The land required for industrial and commercial development over the full period of the plan (to 2050) will be identified, demarcated and formally designated in separate Industrial Area Action Plans'.

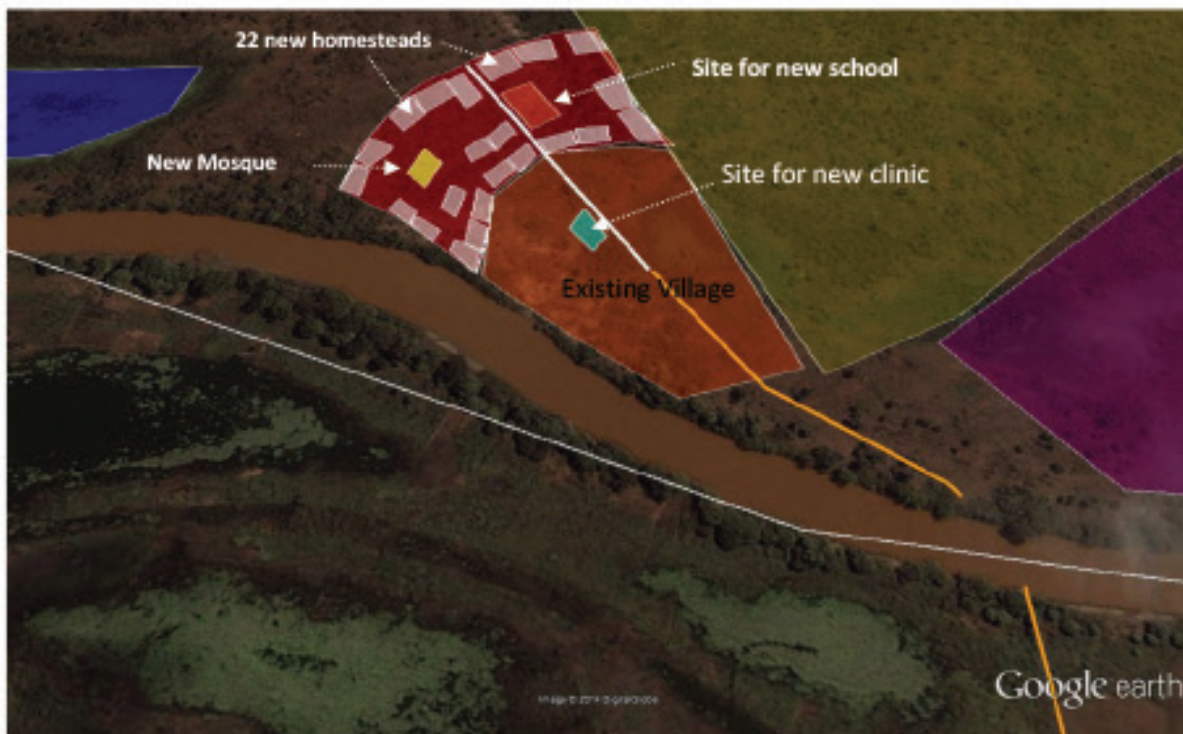


**Figure 8.3 Illustration of Typical Rural Development Plan**

Indicative Map showing typical Rural Development Plan superimposed on Google Image of the Delta



Enlargement of Village Area to show layout of new housing



Source: Tana River Delta Land Use Plan, 2014

## 8.7 Planning Statements and Regulations Relating to Economic Activity

The land use strategy provides a flexible approach to land allocation which will be reviewed at five-year intervals. The aim is to offer guidance to all prospective developers so that they can create their own opportunities while respecting the wider needs of communities and the environment.

### 8.7.1 Livestock Management (LM)

**Statement LM1** 'All grassland, forest and scrub lying outside protected areas but within the designated floodplain will be managed to meet the combined objectives of nature conservation and livestock grazing'.

Livestock grazing and conservation are fully compatible providing stocking levels are regulated to prevent overgrazing. It is inevitable that some overgrazing will occur in extreme droughts but this should be restricted to as short a period as possible.

**Statement LM2** 'In order to achieve better control over grazing pressure, all livestock owners will be required to register their name and entitlement to graze animals within the Delta with the County livestock office by 31 December 2015. Registered owners will be obliged to complete an annual statement confirming the number of animals to be grazed within the Plan Area'.

**Statement LM3** 'The County Government(s) will establish a livestock committee with specific responsibilities for setting up a Grazing Management Plan and introducing proposals for identifying and licensing livestock so that numbers may be regulated in future'.

The land use strategy specifies that no more than 600,000 head of cattle are to be grazed within the Tana Delta Plan area at any time and that this figure is reduced to 200,000 head during the wet seasons.

As part of the overall management plan for the Tana Delta Ramsar site, each part of the floodplain will be inspected and an assessment will be carried out to determine appropriate stocking levels during the wet and dry seasons. This assessment will be made jointly by experts from the relevant conservation bodies and by representatives of the livestock owners, grazers and affected communities.

**Statement LM4** 'A wardening system will be developed, as part of the Tana Delta development programme, using local community members to monitor the effectiveness of the livestock grazing controls'.

In some parts of the designated floodplain, there may be areas of land which are suitable for recession agriculture following seasonal flooding.

**Statement LM5** 'Temporary use of such areas may be granted by the County governments for rain fed and recession farming on an annual basis providing that no permanent structures or mechanised cultivation is introduced. Permission to use parts of the floodplain for farming purposes may be withdrawn at six months' notice; and temporary authorisation for such use does not imply any long-term right for such use'.

### 8.7.2 Agriculture (A)

Small-scale irrigation is seen as an essential development within the Tana Delta in order to provide the necessary water to support intensive vegetable and fruit production. However the opportunities for its development are seriously restricted both by technical considerations and the need to maintain the water balance and ensure that sufficient supplies are available to meet all community and conservation needs.

Technical and scientific studies associated with the development of water resources in the River Tana basin have concluded that the opportunities for substantial irrigation within the Tana Delta are very limited. These conclusions reflect the fact that the River Tana has on many occasions breached its own banks and destroyed flood embankments, canals and levees built as part of large-scale irrigation schemes. In the light of these studies it is clear that any irrigation development in the Tana Delta will need to be planned with the utmost care. The essential requirements for a successful irrigation scheme are:

- a safe and secure abstraction point on the main river (a weir or barrage) which can be overtopped in major floods and is not vulnerable to changes in River course or siltation,
- a gravity based canal system which can convey water from the intake to the intended farming area,
- an irrigation site which can be laid out with minimal soil disturbance or re-grading to accept a sprinkler or drip feed water distribution system, and,
- facilities for redirecting all surplus abstraction water back to the main river channel after use.

Studies undertaken to date suggest that the conditions for a gravity-fed system could best be met in the upper Tana Delta close to the southern boundary of the primate reserve and upstream of the existing TARDA rice farm. There is also the possibility of redesigning and constructing a small irrigation scheme to the east of the Garsen-Witu road and below the Gamba office site. Elsewhere, opportunities may exist for small pumped irrigation schemes on areas of less than 100 ha.



**Statement A1** 'All proposals for the development of irrigation within the Tana Delta will be subject to formal planning applications and the preparation of environmental and social impact studies together with full technical, feasibility and cost benefit studies'.

### **8.7.3 Industrial and Commercial Development (ICD)**

All industrial and commercial development proposals within the Tana Delta will be submitted and evaluated against formal criteria to ensure that they meet national standards for pollution control and health and safety standards. Individual factories and processing plants (such as abattoirs and food processing) which are located on industrial estates will benefit from the provision of a common sewer system and waste water treatment facility in order to ensure that water returned to the Tana Delta is of sufficiently high quality (although preliminary treatment of waste will be the responsibility of the individual operator).

**Statement ICD1** 'The County Governments will actively encourage industrial development proposals if these are located within the planned industrial estates and meet national standards for pollution control and health and safety'.

## **8.8 Climate Change (CC)**

The Tana Delta is one of the areas on the East African coast, which has been identified as being under threat from rising sea level. Current projections suggest that sea level could increase by between half and one metre by 2100. There are already some signs that coastal erosion is increasing at the mouth of the River Tana and along the beaches around Kipini. In addition, seawater incursion is increasing the salinity of groundwater in parts of the lower floodplain. Any changes will be gradual, and will provide plenty of time for adaptation. However, it will be necessary to start planning over the next 5 to 10 years to meet any such eventualities. If sea level were to rise by a metre in the next 80 years, much of the lower floodplain would become saltmarsh and mangrove swamp with large expanses of open brackish water. Such changes would significantly reduce the scope for agriculture activity but could open up opportunities for mariculture (prawn farming). The natural environment would be radically altered from a predominantly freshwater to an intertidal ecosystem but this could increase the nature conservation value and add to the Delta's existing biodiversity and tourism potential.

**Statement CC1** 'All development proposals will be carefully examined to ensure that they comply with national policies on climate change adaptation and can be constructed without adding to safety risks to the local population'.

# GUIDELINES FOR DEVELOPERS, THE PUBLIC AND DECISION-MAKERS

## 9.1 Introduction

This chapter introduces the mechanisms that will be used by key decision-makers to determine which land use options should be positively encouraged within the Tana Delta and under what circumstances certain types of activity should be actively discouraged in the interests of delivering the overall objectives of the Land Use Plan. The main process for decision-making is the use of

'Planning Statements', which represent the official policy of government at both national and county levels. Flowcharts or algorithms will support these for some of the commoner types of development proposal that may be anticipated in the Tana Delta. In addition, a number of guidelines will be written to help inform decision-makers and the public about what constitutes sustainable development.

## 9.2 The Role of Developers

All entrepreneurs, whether from the public or private sector, have a major role to play in the development of the Tana Delta. However, progress will only be made, if innovative proposals are brought forward to create new economic activity, the enhancement of social and community welfare and protection of the environment. In order to ensure that these standards are achieved, developers are encouraged to hold full discussions with the county governments and with local communities before submitting any formal proposals.

Developers are encouraged to study the details in this plan and, in particular the section on land use strategy, in order to align their proposals with the overall plan objectives. Depending upon the complexity and scale of the planned undertaking, developers should follow the following guidelines when submitting a planning application.

### 9.2.1 Statement of Case

A clear statement must be prepared setting out the goals and objectives behind the development. The statement should identify the individuals and parties providing the underlying investment capital and give a clear description of the development itself. The area of land to be occupied should be clearly defined and, if the developer is not the owner, a formal certificate will need to be completed and signed by rightful owners, confirming their agreement to the proposals. Alternatively, if the certificate cannot be completed for any reason, a letter should be submitted.

The applicant should explain how the development is intended to support the policies of this plan and the steps that will be taken to ensure conformity with all policy statements, guidelines and other requirements of the Tana Delta Land Use Plan.

### 9.2.2 Site Plans

Applicants should submit a site Plan to the scale of not more than 1:25,000 identifying the precise area covered by the development proposal. Where buildings or other structures are proposed the scale of the Plan shall be not less than 1:2,500.

### 9.2.3 Environmental and Social Impact Assessment

Notwithstanding the rules for EIA defined by the National Environmental Management Agency (NEMA), any development proposal which would result in any of the following interventions shall be subject to a full Environmental and Social Impact Assessment (ESIA):

1. Use of more than 2 million cubic metres of water a year,
2. Encroachment on any special feature (habitats and settlements identified in Plans 6.5 and 6.6),
3. Displacement of more than 5 homesteads,
4. Development creating more than 100 full time jobs
5. Development displacing more than 100 existing livelihoods.

## 9.3 The Public and Local Communities

Adoption of the Constitution and the formation of County governments provides the opportunity to overcome all of the historic failures of the planning system by introducing fair, open and transparent procedures. Public consultation will lie at the heart of the new process.

### 9.3.1 Public Consultation

All applications for development will be listed and published in national newspapers with details of where the proposals can be inspected. Any development proposals which are potentially in conflict with the Land Use Plan will be referred by the County Government to the village elders in all communities that are potentially affected. No decisions on such applications will be taken until the views of all interested communities have been received and taken into consideration by the County Planning Development Committee.

## **9.4 The Authorities and Decision-makers**

### **9.4.1 Formal Review of Planning Applications**

All development proposals for land falling within the Tana Delta or its buffer zone will be subject to review by the appropriate County Planning Development Committee and by other licensing authorities, where appropriate, such as NEMA or the Kenya Wildlife Service or Kenya Forest Service.

Every planning application will be scrutinised by officers of the relevant County Government and/or Ministries, using the Planning Statements, and flowcharts and guidelines to be set out in a development control scheme to be introduced under the Land Use Plan. The officers will prepare a report for consideration by members of the County Planning Development Committee (CPDC), which describes the nature of the proposed development, lists its performance against the Planning Statements and guidelines, and concludes with a recommendation to approve, approve with conditions or reject the application. The officers' report will note whether any trans-boundary issues are involved which would require referral, comment or direct involvement in the decision-making process by a neighbouring County Government.

### **9.4.2 Decisions by the County Planning Development Committee**

Applications will be considered by the CPDC in the light of:

- all public comments received,
- the views of other relevant authorities,
- The analysis performed by the Council's officers.

Members of the CPDC will reach a majority decision on the application on the basis of the facts presented. Any member of the CPDC who has a personal interest in the outcome of the application will declare this interest and withdraw from the decision-making process.

### **9.4.3 Planning Statements**

The Planning Statements which appear in this Land Use Plan have been carefully drafted and reviewed by the lead ministries at National level and by the County Administrations for Tana County and Lamu Counties. A Planning Statement is not open to amendment or modification (without a formal review and endorsement in accordance with the Planning and County Governments Acts) and its quotation in a formal decision of the County Planning Development Committee shall have the force of law.

Each statement constitutes a 'formal policy' or statement of intent. Decisions on whether a particular application for development will be approved, approved subject to conditions or rejected will be made in the light of how the proposal 'performs against the full range of statements listed for the planning zones within which the development would take place'. (The full range of statements covers zone or area-based, land use and economic activities).

If an application fails to meet the requirements of one or more statements this will not automatically lead to its refusal, providing appropriate mitigation measures can be introduced in accordance with formal planning conditions. However, the more an application conflicts with Planning Statements the more likely it is that the CPDC will decide to reject the proposal.

### **9.4.4 Explanatory Text**

Each Planning Statement is supported by an explanatory text which describes the reasons for introducing the Planning Statement and provides references to additional information where appropriate.

### **9.4.5 Forms of Planning Approval**

Approval of an application for development may be given unconditionally or subject to special conditions that are designed to reduce any areas of adverse environmental impact. Examples of standard conditions will be set out in the 'Development Control Scheme'.

# CHAPTER 10

## GOVERNANCE

### 10.1 Introduction

This chapter discusses the respective roles of the National Government and County Governments in implementing the Tana River Delta Land Use Plan and outlines the measures that will need to be introduced in order to deliver all of the plan objectives. The circumstances surrounding devolution of powers from National to County Governments are particularly fluid at the time of preparing this plan and there is scope for different interpretations to be placed on the relevant laws and regulations since these are not always fully aligned with each other. The statements made in this chapter will be open to review as the plan is considered and adopted at both national and county level.

### 10.2 The Role of National Government

Responsibility for integrated county development plans and county spatial planning is a devolved function under the County Government Act, 2012. However, certain plans may be produced at national level by the Director of Physical Planning under the Physical Planning Act, Revised Edition, 2012. Two categories of nationally formulated plans are relevant to the Tana Delta. The first is the power to create 'Regional Physical Development Plans' (Part IV Sections A 16-17) and the second is the power to declare 'Special Planning Areas' (Part IV, Section 23). It will be important for the relevant national ministries to consider and endorse the planning statements outlined in Chapter 9 (see section 9.4.3).

In addition to physical planning, the National Government continues to administer policies and regulations made under a wide range of legislation where national coordination of resources like water, transport and environment is important. In consequence, bodies like the Kenya Forest Service and Kenya Wildlife Service will continue to be closely involved in protecting gazetted forests, wetlands, endangered species and other environmental features within the Tana Delta. Similarly, the National Land Commission will assume the principal role in adjudicating on the ownership of disputed land holdings. The Ministry of Environment, Water and Natural Resources will oversee future water use and development throughout the country, while the Ministry of Agriculture will direct key decisions on future irrigation schemes.

The Strategic Environmental Assessment for the Tana Delta has shown that the long term prosperity of the

entire North East region will be dependant upon careful rationalisation of land uses throughout the Tana River Basin and adjacent systems like the River Athi catchment. Competing demands and interests will need to be assessed by Government and firm policies put in place to cover irrigation development, industrial and residential growth, transport, tourism and a wide range of other economic activities throughout the region.

In order to achieve the necessary level of coordination at national level it is recommended that the government should establish a Deltas Board. This should be officially gazetted as the organisation with the necessary powers to oversee policies in special areas like the Tana Delta.

The Deltas Board will be supported by the Inter-Ministerial Technical Committee (IMTC) on the Sustainable Management of Kenya Deltas. The IMTC includes representatives of all of the main ministries. This Committee will meet as and when required, but not less frequently than twice a year to consider progress in the implementation of the Tana Delta Land Use Plan (and land use plans for other deltas when these are formulated).

### 10.3 The Role of the National Land Commission

The system of land use and decisions relating to land tenure has failed to take into consideration customary rights of communities within the Tana Delta and there are a number of disputed land holdings. These concerns underlie many of the disputes which have led to unrest and violence within the Delta. A conscious decision was taken when developing the Land Use Plan, that these historic injustices and disputes should not be allowed to influence rational plan-making and so all areas within the Tana Delta have been examined dispassionately without concern for ownership, to determine what their most beneficial and practical uses might be within the constraints and opportunities posed by the vision and goals for the protection of this internationally important resource. The National Land Commission will focus its attention on constitutional rights of individual citizens, the legal framework and policies relating to land tenure, but it will also take fully into account the status of the Land Use Plan and the highly consultative process that has been used to generate the plan.

## 10.4 The Role of the Judiciary

Local communities within the Tana Delta have pursued civil actions in the recent past in order to press the case for their own voices to be heard on land use planning decisions within the Tana Delta. The most recent court judgement found strongly in favour of community interests with some pointed criticism of the roles played by national agencies. A major constraint in the past has been the absence of any form of land use plan to guide collective decisions. Adoption of this Land Use Plan will provide, for the first time, a clear set of goals and objectives for the Tana River Delta. As such it will become a key reference document for the civil courts at both county and national level when determining future legal responses.

## 10.5 The Role of County Government

Primary responsibility for land use and urban planning falls on the County governments under the County Government Act, 2012 and each County has already produced an initial County Integrated Development Plan which will be extended over time. However, the Act sets specific obligations on each County to prepare a hierarchy of plans. The Tana Delta Land Use Plan is one of the first plans in Kenya to tackle a broad range of planning, land use and community issues over a large area administered by two county authorities.

Counties are in the process of establishing their own planning departments and it is clear in the case of the Tana Delta that additional resources will be required both in terms of staff and finances in order to deliver the full agenda. The scale of the challenges facing the Tana Delta has been fully reviewed in the Strategic Environmental Assessment (Odhengo *et al*, 2014a) and this study has exposed the complexities of many of the key issues summarised in Chapter 2 of this Plan. In order to address these challenges, it will be critical to provide the Governors' administrations, Senators, all Members of Parliament (MPs) and Members of the County Assemblies (MCAs) with detailed briefings on the plan and SEA findings and the ways in which the plan policies and planning statements are to be used to ensure that sustainable development is achieved.

There has been much criticism in Kenya of the ways in which politicians have used their official positions to further their own interests and it will be essential that appropriate checks and balances are put in place under the county governance structures to implement the Tana Delta Land Use Plan.

The most critical role of the county governments will be to review and reach decisions on future development proposals affecting the Tana Delta. This will necessitate

the establishment of a planning committee under the County Assemblies, which can scrutinise and make recommendations on all proposals. Some proposals will be of a sufficient size and importance to require ratification and approval by the full County Assembly(s) but others may be decided by the planning committee using delegated powers, the details of which will need to be formalised in the Development Control Scheme.

## 10.6 The Role of Communities and Individuals

The County Governments Act, 2012, sets out very clearly the obligations on government in relation to citizens under Part VIII – Citizen Participation, S.87 including providing:

1. timely access to information, data, documents and other information relevant or related to policy formulation and implementation;
2. reasonable access to the process of formulating and implementing policies, laws and regulations, including the approval of development proposals, projects and budgets, the granting of permits and the establishment of specific performance standards.

Until the Tana Delta Land Use Planning process was initiated in 2011, most if not all communities in the Delta felt totally marginalised and neglected. After long periods of neglect by public administrations it is understandable that suspicions should remain at community level and it will take time until all bodies feel that they have a genuine voice. Nevertheless, the initial work of the **Tana Planning Advisory Committee (TPAC)** over the last two years has proved beyond all doubt that it is possible for all community interests to engage in dialogue about future planning objectives even when tensions between different groups have been exceedingly high.

The **TPAC** is seen as having a central role in ensuring the successful implementation of the Tana Delta Land Use Plan. Its role will need to be formalised in relation to existing governance structures within individual ethnic groups. A fundamental principle of the TPAC is that its membership should be truly representative of marginal groups and individuals and should achieve a full gender balance.

The principal role of the TPAC will be to act as a sounding board of community views on all planning issues within the Tana Delta for the benefit of National and County governments, and as a conduit for sharing information down to individual communities.

The TPAC will receive an annual report on progress in implementing the Tana Delta Land Use Plan, covering all elements of the plan. This report will include a full update



on implementation of urban and rural settlement plans, land use statistics, information on local conflicts over land and water, measures to preserve key environmental habitats, the creation of new livelihoods and jobs, and promotion of tourism and industry, amongst other things.

The County Government Act, 2012 sets out the framework for engagement of communities in spatial planning and specifically requires that counties 'shall designate county departments, cities and urban areas, sub-counties and Wards as planning authorities'. In addition to the county planning departments in Homa Bay and Lamu, planning functions will also be exercised in the urban areas designated under this Plan (Garsen, Witu and Tarasaa) and individual Wards.

### **10.7 The Role of Civil Society and Non-Government Organisations**

A number of civil society and non-governmental organisations have played a highly significant role in assisting local communities to improve livelihoods, reduce the risks of natural disasters and defend their rights. These bodies have included the Kenya Red Cross, Action Aid, World Wide Fund for Nature (WWF) and others. The most active in terms of supporting the Tana Delta Land Use Plan and SEA has been Nature Kenya, which formed a unique partnership with government in order to bring together the official powers for plan-making with community-oriented liaison and advocacy. In addition to supporting the planning process with staff from its full time office in Garsen, Nature Kenya has also been demonstrating practical solutions to sustainable livelihoods development in a number of pilot settlements throughout the Delta including Walkon, Hurara, Ozi, Wema, Hewani, Onkolde, Moa, Shirikisho, Ziwani and Kipao Villages.

While most activities undertaken by the voluntary sector have been beneficial for the Tana Delta there are times when the multiplicity of external interests who have sought to engage, out of very sound humanitarian or environmental concern, in research, project development and aid relief has caused confusion and competition for resources. It will, therefore be critical that future efforts by civil society and non-governmental organisations are coordinated closely with the overarching objectives of the Tana Delta Land Use Plan.

### **10.8 Administration of the Land Use Plan**

The process of administering the Tana Delta Land Use Plan and making sure that its policies, regulations and guidelines are observed will be a continuous exercise and will demand a high level of planning expertise and dedication on the part of the County Government officers who are delegated to manage the Plan.

Specific requirements are set out in the County Governments Act, 2012 in relation to production of the Integrated County Development Plan, County Sectoral Plans, County Spatial Plans and (under the Urban Areas and Cities Act) cities and urban area plans.

The Tana Delta Land Use Plan is a spatial plan under the meaning of the County Governments Act which defines such plans as 'ten year county GIS based database system spatial plans, which shall be a component of the county integrated development plan'.

The extent of the area covered by the Tana LUP and the complexity of the planning issues that are raised will require a level of resources beyond those that can be supported by the Planning Officer to be appointed by each county government.

It is anticipated that, in addition to the county planning officer and technical support staff who will deal with individual planning applications, there will need to be a full time Coordinator/Project Manager for the Tana Delta. This individual will need to have the full confidence of the County Assemblies and Governors and be able to operate at a sufficiently senior level to interact with National Government ministries, international funding partners, national and international investors and all community groups.

The principal role of the Tana Delta LUP Coordinator/Project Manager will be to advance the individual objectives of the plan, including promoting industrial and commercial development, stimulating private sector interest, delivering Urban and Rural Development Plans to time, overseeing surveys and generally assisting the Governors to achieve the LUP vision and goals.

## LINKS TO OTHER PLANS AND PROGRAMMES

### 8.1 Introduction

The chapter covers links between the Land Use Plan and other plans, strategies and management plans for:

- i. Ramsar Site Management
- ii. Protected and Gazetted Areas
- iii. Water
- iv. Agriculture
- v. Economic Development
- vi. Coastal Planning and Integrated Coastal Zone Management
- vii. Climate change adaptation

Its principal purpose is to highlight the high level of interaction that is required between all planning processes and to ensure that the Tana Delta's needs are fully recognised in other development plans.

### 11.2 Ramsar Management Plan

The Tana Delta was declared a Ramsar site and a Wetland of International Importance on 12th October, 2012. A key aim of designation is that this area, the second most important estuarine and deltaic ecosystem in Eastern Africa, should be preserved for future generations. This will require detailed and careful management of the mosaic of individual habitats that are listed in the Ramsar citation. (See Box 11.1).

Individual habitats have distinct scientific characteristics in terms of the species of plants and animals that are

present, but the distinctions between one habitat and another are often too precise to be relevant for broad land use planning purposes. Consequently, the land use classes that have been defined in the Tana Delta Land Use Plan will often contain more than one habitat type.

The Land Use Plan defines the policies and principles that will be applied to each land class through the use of planning statements when considering development proposals (see Chapter 9). However, there is a need for more precise guidance on how to protect and maintain individual habitats and this is the role of the Management Plan for the Ramsar site.

The Management Plan for the Tana Delta Ramsar site, which is being coordinated by NEMA, KWS and other government agencies, will be prepared in accordance with the Management Plan Guidelines approved in Spain (2002) entitled *"New Guidelines for management planning for Ramsar sites and other wetlands - Adopted by Resolution VIII.14 (2002) of the Ramsar Convention"*.

A key message in these guidelines (item 4) is that "Ramsar site management plans should be integrated into the public development planning system at local, regional or national level. The integration of site management plans into spatial and economic planning at the appropriate level will ensure implementation, public participation and local ownership. Furthermore, integration will enhance

#### BOX 11.1 Selected Habitats defined in the Ramsar Citation for the Tana Delta

Ts	Seasonal marshes on inorganic soil (the floodplains)	450 km <sup>2</sup>
A	Permanent shallow marine waters	235 km <sup>2</sup>
I	Intertidal forested wetlands (mangroves)	45 km <sup>2</sup>
4	Seasonally flooded agricultural land	40 km <sup>2</sup>
Xf	Freshwater tree-dominated wetlands	20 km <sup>2</sup>
G	Intertidal mud, sand or salt flats	15 km <sup>2</sup>
P	Permanent freshwater lakes	10 km <sup>2</sup>
M	Permanent rivers, streams, creeks	10 km <sup>2</sup>
E	Sandy shores	8 km <sup>2</sup>
N	Seasonal rivers, streams, creeks	8 km <sup>2</sup>
J	Coastal saline lagoons	3 km <sup>2</sup>
F	Estuarine waters	3 km <sup>2</sup>
P	Seasonal freshwater lakes	2 km <sup>2</sup>
Tp	Permanent freshwater marshes	<1 km <sup>2</sup>
3	Irrigated land	<1 km <sup>2</sup>
9	Canals	<1 km <sup>2</sup>

the possibility of local as well as external funding". Delivery of this objective has been a key component in creating the framework of the Land Use Plan.

### 11.3 Protected Forests and Gazetted Areas

The Forests Act, 2005 defines State forests as areas of forest that were formally declared and gazetted before the passage of the Act, and adds further definitions of forest to include indigenous forest (containing native tree species including Mangrove and bamboo); community forests (managed by local community associations) and plantations (managed commercially). Under the Act, the Director of the Kenya Forest Service may enter into agreement with private and community associations to develop management plans for forests. Section 40 (1) of the Act makes specific reference to forestry management in indigenous forests, which include most of the forests present in the Tana Delta:

"All indigenous forests and woodlands shall be managed on a sustainable basis for purposes of:-

- a. conservation of water, soil and biodiversity;
- b. riverine and shoreline protection;
- c. cultural use and heritage;
- d. recreation and tourism;
- e. sustainable production of wood and non-wood products;
- f. carbon sequestration and other environmental services;
- g. education and research purposes; and
- h. habitat for wildlife in terrestrial forests and fisheries in mangrove forests.

These principles are also enshrined in the planning policies and Planning Statements of the Tana Delta Land Use Plan.

Another important power introduced by section 46 of the Forests Act, 2005 is to establish community forest associations and grant these bodies rights to participate in the management or conservation of a forest or part of a forest in order to:

- a. protect, conserve and manage such forest or part thereof pursuant to an approved management agreement entered into under this Act and the provisions of the management plan for the forest;
- b. formulate and implement forest programmes consistent with the traditional forest user rights of the community concerned in accordance with sustainable use criteria;
- c. protect sacred groves and protected trees;
- d. assist the Forest Service in enforcing the provisions of (the) Act and any rules and regulations made pursuant thereto, in particular in relation to illegal harvesting of forest produce;

- e. with the approval of the Board enter into partnerships with other persons for the purposes of ensuring the efficient and sustainable conservation and management of forests;
- f. keep the Service informed of any developments, changes and occurrences within the forest which are critical for the conservation of biodiversity;
- g. help in fire fighting; and
- h. do any other act that is necessary for the efficient conservation and management of the forest.

Management agreements between the Director of the Forest Service and individual associations may confer on the association all or any of the following forest user rights –

- a. collection of medicinal herbs;
- b. harvesting of honey;
- c. harvesting of timber or fuel wood;
- d. grass harvesting and grazing;
- e. collection of forest produce for community based industries;
- f. ecotourism and recreational activities;
- g. scientific and education activities;
- h. plantation establishment through non-resident cultivation;
- i. contracts to assist in carrying out specified silvicultural operations;
- j. development of community wood and non-wood forest based industries; and
- k. other benefits which may from time to time be agreed.

(Government of Kenya, 2005)

The provisions of the Forest Act 2005, accord closely with the overall objectives of the Tana Delta Land Use Plan and every effort will be made by the Tana and Lamu county governments and Kenya Forest Service to encourage the establishment of community forest associations and to develop integrated management plans for all forest areas in the Plan Area. Similar measures will be promoted between the public authorities and private enterprises and individuals owning forests within the Plan Area.

### 11.4 Water Resources

Water is the most important resource within the Tana Delta and the Land Use Plan has defined for the first time the conditions that will need to be met in order to safeguard future water supplies in perpetuity. However, the Plan recognises that this goal will only be met if water resources are managed equitably and sustainably throughout the rest of the River Tana Basin. Responsibility for water policy is vested in the Ministry of Environment, Water and Natural Resources, while the Water Resources Management Agency (WRMA) is

engaged in strategic management and development of water resources. Significant progress has been made in reforming the water sector following adoption of the National Water Policy in 1999. This has included:

- Enactment and operationalisation of the Water Act 2002;
- Development and finalization of the Water Resources Management Strategy (first edition 2007);
- Production of an Integrated Water Resources and Water Efficiency Plan (August 2009) and
- Finalisation of the Catchment Management Strategies (CMS).

In accordance with the Water Act 2002 a first edition of the National Water Resources Management was developed in 2007- 2009. The strategy describes how water resources shall be managed, protected, used, developed, conserved and controlled. One of its seven principle objectives is the need to create mechanisms for integrating land and water resources planning and management on a catchment basis.

Catchment Management Strategies have been prepared for all six major river basins, including the River Tana, based on a series of consultative meetings in which stakeholders' views were sought and incorporated into the final CMS. WRMA notes in its website that the River Tana catchment is faced by a number of challenges, including:

- Acute water scarcity
- Pollution of water resources from both point and non-point pollution sources
- Catchment degradation especially on Mt. Kenya and on slopes of Aberdares ranges
- Soil erosion and overgrazing in the lower parts of the region
- Human encroachments into the watershed
- High groundwater salinity in Lower Tana, in the coastal zone, due to over-exploitation
- Seawater intrusion affecting the quality of groundwater
- Increased water resource demand, urbanization and industrialization.

These findings are supported by the SEA analysis for the Tana Delta Land Use Plan. Within each river basin, sub-catchments are defined, each of which will require its own management plan. Under the principles of integrated water resource management (IWRM), the intention is that sub-catchment plans will be developed with the active assistance of Water Resource User Associations (WRUAs). A WRUA has been set up to cover the lower River Tana basin including the delta area. There are, however, many challenges affecting the role and functions of WRUAs, including the absence of adequate funds, so it will take time before these institutions become fully effective.

The most important component for future water resource planning will concern the level of storage that can be provided within each catchment. In the case of the River Tana Basin and Tana Delta, key decisions remain to be taken by government on the construction programmes for the High Grand Falls Dam and its associated downstream storage reservoir. Failure to address the social, environmental and economic issues relating to these major water resource projects could jeopardize a number of Vision 2030 flagship projects including the LAPSET corridor developments and reconstruction of major irrigation schemes. There therefore needs to be the closest cooperation between the two Governments of Tana and Lamu Counties, the Ministry of Environment, Water and Natural Resources and WRMA.

## 11.5 Agriculture and Irrigation

A strategy for agricultural sector development (2010-2020) was published by the government in 2010 and contained a national Irrigation policy and legal framework (Government of Kenya, 2010). The overall goal of this intervention is to accelerate sustainable development of irrigation and drainage to contribute to the national goals of wealth and employment creation, food security and poverty reduction. This is also stated to be in line with the country's aspirations for transforming agriculture as underpinned by Vision 2030.

The policy on irrigation and drainage will seek to achieve the following:

- fully develop and exploit the irrigation and drainage potential in the country to achieve food security, create employment, supply raw materials and reduce poverty.
- effectively promote, coordinate, manage and regulate the core activities within the irrigation and drainage subsector.

Under the 2010-2020 strategy it is proposed that construction of the Tana Delta Project, aimed at irrigated sugar production covering 16,000 ha, should be given the highest priority (Government of Kenya, 2010). Many of the agricultural and irrigation initiatives proposed in the Agricultural Sector Development Strategy contradict environmental and social safeguards that are built into the same strategy, including its own policies on environment, wetlands and forests. The strategy acknowledges under a section (6.4.1) on challenges and constraints, the following findings of fact:

"Water catchments are being encroached and converted into agricultural land. This has led to reduced water levels in rivers, drying up of seasonal rivers and destruction of fragile ecosystems. Vital for carbon sequestration, wetlands are lost every day to agricultural production (Frenken, 2005)."

The extensive research undertaken for the Tana Delta Land Use Plan, combined with the findings from its highly inclusive socio-economic survey of over 80 villages, confirms this analysis and shows that the aspirations to turn the Tana Delta into a large mono-culture irrigated development scheme are ill-founded and would not only destroy the integrity of this international wetland but would also inflame local tensions, leading to renewed conflict.

Instead, the Land Use Plan puts forward innovative proposals for community-based public-private partnership agricultural schemes focused on high value vegetable, fruit and livestock development. Analysis shows that the net benefits to the Tana Delta economy, social welfare and environment will greatly exceed other options and the active support of the Ministry of Agriculture will be sought in order to implement this alternative vision for the Delta.

## 11.6 Economic Development

An important role of the technical studies underpinning the Tana Delta Land Use Plan has been to explore the realistic opportunities for promoting new forms of economic development within the Plan area over the next forty years in support of the underlying concepts of Vision 2030. It is widely accepted that the initial process of generating Vision 2030 failed to include a proper assessment of the social and environmental consequences of large scale development projects, as is now required by the Constitution. However, by combining plan-making and environmental assessment, the Tana Delta Land Use Plan has broken new ground in generating a list of potential new industrial and commercial activities for the Delta area, and in allocating land for the creation of the necessary industrial estates, which can be accommodated within the environmental footprint of the Delta.

The Land Use Plan recognises the importance of the changes that are being made, and will continue to be made, in road, rail, power and water infrastructure over the next four decades in support of the development of the new port at Lamu and anticipates rising demand for finished products from the Delta including meat, food and products from natural resources including essential oils.

Another major opportunity for the Tana Delta lies in the promotion of eco-tourism. An initial tourism master plan was prepared for TARDA in 2007 but has not been developed to any significant extent. There is renewed interest in developing tourism strategies and plans at national level with the recent publication of the Sustainable Tourism Master Plan for the Inter-

Governmental Authority on Development (IGAD) Region (2013-2023).

The two County Governments will work closely with their counterparts in national government to refine the list of economic development opportunities for the Plan Area.

## 11.7 Coastal Planning

In addition to lying within the River Tana Basin, much of the Tana Delta also forms part of the coastal zone, where a number of major planning initiatives are planned by both government agencies like the Coast Development Authority and international partners. The government has secured a large grant from the International Monetary Fund (IMF) and the World Bank to carry out a coastal development project with four main components. These cover sustainable management of fisheries resources, sound management of natural resources, support for alternative livelihoods and capacity building. A number of the planned initiatives could be very beneficial within the Tana Delta and would help to underpin the Land Use Plan's overall objectives.

Integrated coastal management is one of the elements in this development programme and is linked with publication of a draft Integrated Coastal Zone Management Policy in December 2013.

## 11.8 Climate Change Adaptation

The government is advancing plans to respond to the anticipated changes in climatic conditions as a result of global warming and its National Climate Change Action Plan (NCCAP) covers the period 2013-2017. This sets out a 'low carbon climate resilient development pathway, to help meet Vision 2030 with an action plan that addresses both sustainable development and climate change' (Government of Kenya, 2012).

Specific measures include:

**Agriculture:** promoting irrigated agriculture, promoting conservation agriculture, value addition to agricultural products, developing weather indexed crop insurance schemes, support for community-based adaptation including provision of climate information to farmers, and enhanced financial and technical support to drought resistant crops.

**Livestock and Pastoralism:** Breeding animals tolerant to local climatic conditions, weather indexed livestock insurance, establishment of fodder banks, documenting indigenous knowledge, provision of water for livestock and humans, early warning systems for droughts and floods, and vaccination campaigns.



**Water Resources:** Enforcement and/or enactment of laws for efficient water resource management, increasing capture and retention of rainwater, water quality monitoring, de-silting rivers and dams, protecting and conserving water catchment areas, investing in decentralized municipal water recycling facilities, campaigns on water harvesting, developing hydrometric networks to monitor river flows and flood warning.

**Forestry:** Intensified afforestation, promoting agroforestry-based alternative livelihood systems, promoting alternative energy sources, community forest

management, REDD+ initiatives and reduced mono-species plantation stands.

**Energy:** promoting the use of alternative energy including geothermal, wind, solar and mini hydropower generation; and the promotion of improved cook stoves (Government of Kenya, 2012).

There are close parallels between the Tana Delta Land Use Plan and these national objectives, and the County Governments will work closely with the national government to achieve their common aims.

# CHAPTER 12

## MONITORING AND EVALUATION OF THE PLAN

### 12.1 Introduction

The Land Use Plan is not a static product but will need to be revised at five yearly intervals in accordance with section 110 (4) (County Spatial Plans). “Each county spatial plan shall be reviewed every five years and the revisions approved by the respective county assemblies”. A number of key issues will need to be monitored and evaluated using GIS and these include:

- i. Population Growth
- ii. Water Supply and Demand
- iii. Livestock numbers
- iv. Land use
- v. Habitat condition
- vi. Social conditions
- vii. Economic conditions

### 12.2 Use of a Geographic Information System (GIS)

The most effective way of monitoring the successes and failures of the Tana Delta Land Use Plan will be to develop and enlarge the existing GIS created for the preparatory studies so that accurate maps and plans can be produced for all parts of the Plan Area. The GIS will form the basis of individual development plans for both urban and rural areas – of the type illustrated in Chapter 13. Operation of a GIS is relatively straightforward but the process requires a skilled operator and is a data intensive and time-consuming process.

### 12.3 Population Growth

The Tana River Delta SEA highlights population growth from natural increase and inward migration as one of the greatest internal challenges to achieving a sustainable balance of land uses within the Tana Delta. Although current tensions are caused largely by disputes over access to land and water, the underlying reason for the conflicts is often related to the spread of settlements and the number of people who have to rely on diminishing resources. Sixty years ago, the majority of current villages did not exist and these problems were relatively minor but the population of the Delta is likely to double in the next 25 years and more than treble in size by 2050 unless measures are taken to reverse the current trends.

It is imperative that accurate data is collected at the next census on the distribution of population throughout the Delta and within the Buffer Zone and that programmes for encouraging effective family planning are developed and assessed on a yearly basis.

### 12.4 Water Supply and Demand

Monitoring the demand, use and availability of water will be one of the most critical undertakings for the Tana Delta Land Use Plan. However, the issues are complex and will need to be tackled from national to county levels by a number of different organisations. At national level the Ministry of Environment, Water and Natural Resources and WRMA will need to expand and improve their knowledge and understanding of the entire hydrological system of the River Tana Basin. To date research has been concentrated largely on the upper catchment, with a limited amount of evaluation in the middle basin between Garissa and Hola. There has been minimal monitoring or research in the lower basin from Hola to the sea. Continuous real time gauging of the River Tana flows should be established at Hola and Garsen and detailed surveys should be undertaken to determine the existence of ‘hidden’ channels that carry floodwater away from the main river channels. A full hydrological study should be commissioned for the middle and lower River Tana and its results should be published and analysed before the High Grand Falls Dam is constructed.

### 12.5 Livestock Numbers

The first step towards creating a monitoring framework for livestock should be registration of the ownership and size of all existing herds of cattle, and flocks of goats and sheep that are grazed within the Delta. This process of registration should be supported by direct counting in the field. The proposal to establish a livestock wardening system should include annual records of the numbers and condition of livestock being driven into the Delta area during dry seasons from outlying areas. Results of these surveys should be analysed and published annually with the aim of ensuring that total numbers of livestock are brought within sustainable grazing capacity within ten years.

### 12.6 Land Use

Accurate mapping of the extent of different land uses within the Tana Delta is an important requirement of the Land Use Plan. Studies undertaken as part of the LUP preparation have highlighted some of the difficulties in creating maps using geographic positioning to identify specific locations in the field. These difficulties are not technical in nature but arise from levels of suspicion and mistrust on the part of local communities about the functions and purposes to which the information will be put.

Communities are understandably concerned about all aspects of surveying because in the past there have been deliberate attempts by investors to 'establish' title and ownership to areas by placing beacons and markers on the ground. It will be important for the Governments of Tana River and Lamu Counties to establish survey teams to undertake mapping exercises throughout the Tana Delta. The roles and functions of these teams will need to be carefully explained to all community leaders. Land Use survey teams will work with the County Land Use Planners to prepare accurate boundary maps for all urban and rural development plans.

### **12.7 Habitat Condition**

Safeguarding the nature conservation interests and biodiversity of the Tana Delta will require regular monitoring of certain key habitats, like Riverine Forests and also species of plants and animals that are sensitive to changes in environmental conditions. These monitoring targets should be linked where possible to existing surveys, for example bird counts.

### **12.8 Social Conditions**

The ten yearly census is the most comprehensive source of data on social conditions across Kenya and it is built up from detailed information gathered at Ward or Enumerator level. However, collecting such information within a remote area like the Tana Delta can be very difficult due to lack of access, especially during periods of flooding; and because literacy levels are so low. The level of information used in preparation of this first Tana Delta Land Use Plan has been aggregated at former district level and this imposes some considerable limitations on closer analysis of individual wards. It will be important for the first, and subsequent reviews of the LUP to ensure that all social data can be accessed at the Ward level.

### **12.9 Economic Conditions**

More detailed information is required within the Tana Delta on the number of formal jobs that are available and on patterns of livelihoods. An economic development unit should be established within each County to monitor the number of business enterprises, employers and employees and this information should be updated on an annual basis.

# CHAPTER 13

## THE ACTION PLAN

### 13.1 Introduction

Throughout this document there are references to actions that will need to be taken in order to secure successful implementation the Tana Delta Land Use Plan. This chapter draws together the different themes and actions in order to make it easier for the relevant

authorities to develop appropriate programmes and to provide the communities, civil societies and NGOs with a checklist for encouraging public action and also planning their own support. The list of activities is shown in Table 13.1 and is followed with a summary description of each activity and task.

**Table 13.1 Action Plan**

No.	Action	Plan section	Responsibility	Timescale
1.	Create a land and water register	8.2 (3) –(4)	County Governments	Within 6 months (2015)
2.	Register all land use activities involving abstraction of water from the River Tana	8.2 (3) and (5)	County Governments	18 months (2016)
3.	Introduce formal application system for permission to abstract water within the Tana Delta	8.2 (9)	County Governments	1 January 2017
4.	Confirm hierarchy of settlements and prepare Urban Development Plans (Planning Statement S1)	8.2.2.3 8.6.8	County planning departments	2 years (by 2017)
5.	Carry out surveys of all settlements and produce Rural Development Plans (Planning Statement S2)	8.2.2.3 8.6.6	County planning departments	5 years (by 2019)
6.	Identify, survey and formally designate industrial zones and prepare Industrial Area Action Plans by 2016	8.6.9	County planning departments	2 years (by 2017)
7.	Prepare an integrated Water and Land Management Action Plan for the Upper Delta	8.4	County Governments /WRMA	3 years (by 2018)
8.	Undertake a full land use survey of the terraces (Planning Statement LD6)	8.5	County planning departments	2 years (by 2017)
9.	Undertake a land use survey of wetland farming areas and produce related maps	8.6.2	County planning departments	2 years (by 2017)
10.	Progressively refine the overall land use classes map for the Plan Area	8.6	County planning departments	5 years (by 2019)
11.	Make presentations nationally on the need for revisions affecting water resources, irrigation and agriculture policies, plans, programmes and strategies	(Ch.11)	County Governors / County Assemblies	On a continuous basis

No.	Action	Plan section	Responsibility	Timescale
12.	Create a water-balance model for the Plan Area with estimates of all current uses and a framework for analysis of future developments	8.2 (3) 8.4	County Governments /WRMA	2 years (by 2017)
13.	Create an accurate base map using GIS for all forest areas (Planning Statement DF1)	8.6.7	County Planning Departments /KFS	Within 6 months (2015)
14.	Create management plans for all forests	8.6.5 8.6.7	County Planning Departments /KFS/KWS/NEMA	Within 2 years (2017)
15.	Introduce livestock registration (Planning Statement LM2)	8.7.1	County Livestock Department	By December 2016
16.	Establish a livestock committee (Planning Statement LM3)		County Governments	Within 6 months (2015)
17.	Develop a livestock management plan	8.7.1	County Governments	Within 6 months (2015)
18.	Establish a livestock wardening system (Planning Statement LM4)	8.7.1	County Governments	Within 6 months (2015)
19.	Identify and map areas used for flood recession farming	8.7.2	County planning departments	2 years (by 2017)

## 13.2 Brief Description of Actions Required

### 13.2.1 Create a Land and Water Register

The Governments of Tana River and Lamu Counties will establish a land and water register in electronic list format for recording the names and locations of all enterprises that are currently abstracting water from the River Tana within the Tana Delta.

### 13.2.2 Register all Land Use Activities involving Abstraction of Water from the River Tana

All water users within the Tana Delta will be required to submit details of their activities and estimates of the quantities of water abstracted annually from the River Tana.

### 13.2.3 Introduce formal application system for permission to abstract water within the Tana Delta

From 1st January 2017 it will be a legal requirement for all water users within the Tana Delta to apply for permission from the relevant County Government in order to continue extracting water from the River Tana. Proposals involving more than 10 million cubic metres a year (equivalent to 0.3 m<sup>3</sup>/sec) will require a full EIA and

may be refused if the scheme would have a significant effect on the cumulative mean monthly discharge level of 60 m<sup>3</sup>/sec.

### 13.2.4 Confirm Hierarchy of Settlements and Prepare Urban Development Plans

Following publication and consultation on the Tana Delta Land Use Plan, the County Governments will review the proposed designation of Garsen, Witu, Kipini and Tarasaa as urban centres (and any other candidate settlements proposed through a consultative process) and confirm the hierarchy of urban centres. Work will then commence on drawing up full Urban Development Plans for these centres.

### 13.2.5 Carry out Surveys of all Settlements and Produce Rural Development Plans

There are in excess of eighty settlements (groups of more than 10 households) within the Tana Delta and new villages are being created as the population expands. The village appraisals undertaken as part of the Tana Delta Land Use Plan will be followed up by formal survey to record accurate positions for all the main development (buildings/compounds) and land uses using global positioning by satellite (GPS) instruments.



Rural development plans will be prepared for settlements meeting the criteria (villages in existence for more than ten years and lying outside the flood zone of the River Tana).

### **13.2.6 Identify, Survey and Formally Designate Industrial Zones and Prepare Industrial Area Action Plans**

As specified in the Tana Delta Land Use Plan, four industrial estates will be established in the main urban centres of Garsen, Witu, Tarasaa and Kipini. Land surveys will be undertaken to determine the most appropriate locations and to establish the need for relocation and compensation of any existing land user in these areas. The industrial estate boundaries will be formally established and wayleave access for all services will be safeguarded. Specific action plans will be drawn up to guide the development of these estates over the next 5-10 years.

### **13.2.7 Prepare an integrated Water and Land Management Action Plan for the Upper Delta**

The Upper Delta holds much of the land that is suitable for agricultural development linked with seasonal or permanent (pumped and gravity-fed) irrigation. Redevelopment of the former TARDA Integrated Rice Project is already in progress but will need to be rationalised in accordance with the provisions of the Tana Delta Land Use Plan. The Upper Delta will therefore form the focus of an integrated land and water action plan to guide future development in this area.

### **13.2.8 Undertake a Full Land Use Survey of the Terraces**

A full physical survey is required for the terraces, using aerial photography, landsat (satellite) images (processed by NASA and utilised by Google Earth) and ground reconnaissance to map, accurately, the extent of existing settlement and land use. This is particularly important on the Western Terrace where random development and encroachment is occurring on a daily basis. The survey will identify those areas suitable for agricultural development, principally by communal/PPP schemes but also for subsistence. Detailed maps of the areas will be prepared by the GIS Unit of the County Governments.

### **13.2.9 Undertake a Land Use Survey of Wetland Farming Areas and Produce Related Maps**

Existing wetland farming areas are adversely affected by reduction in river flows, changes in flooding regime, climate change and in some areas saline water intrusion. There are no accurate maps showing the extent of affected areas or the basic patterns of land use. A full survey will be undertaken of the land use, land capacity, soils potential and water availability in order to provide more accurate information for future planning in these

areas, including adaptation to the effects of climate change and sea level rise. The results will be transferred to the database maintained by the GIS Unit and used for producing up-to-date maps.

### **13.2.10 Progressively Refine the Overall Land Use Classes Map for the Plan Area**

There have been no systematic mapping exercises covering the whole of the Tana Delta, and it will be necessary to take the initial base maps generated by the Land Use Plan process and update these as time progresses.

### **13.2.11 Make Presentations Nationally on the Need for Revisions affecting Water Resources, irrigation and Agriculture Policies, Plans, Programmes and Strategies**

In the past, many of the key decisions on development, water and land use affecting the Tana Delta were made by the National Government, county councils, agencies and developers in the upper and middle parts of the River Tana Basin. The Governments of Tana River and Lamu Counties should combine resources and seek a more permanent voice in regional decision-making in order to protect the long-term interests of the Tana Delta.

### **13.2.12 Create a Water-balance Model for the Plan Area with Estimates of all Current Uses and a Framework for Analysis of Future Developments**

A number of important scientific studies are being undertaken within the Tana Delta by university researchers and a group of specialists (KENWEB) based at the National Museums of Kenya, but there is a need for a coordinated programme of hydrological and socio-economic research to help develop an accurate water balance model for the whole of the Delta. The water balance model is needed to assist the County Governments in reaching decisions on future development proposals that have high water demands.

### **13.2.13 Create an Accurate Base Map using GIS for all Forest Areas**

The actual extent of woodland and forest within the Tana Delta has not been mapped accurately and even the boundaries of some gazetted and protected forests have been destroyed by encroachment and deliberate clearance by developers. An important task for the GIS Unit will be to work with the Kenya Forest Service and National Remote sensing centre to prepare new maps of all forests within the Delta.

### **13.2.14 Create Management Plans for all Forests**

The Forests Act 2005 provides for the creation of management plans, including the involvement of local communities who have registered as community forest associations. Forest management plans should

be prepared for all forests within the Tana Delta in conjunction with development of the Ramsar Management Plan.

#### **13.2.15 Introduce livestock registration (Planning Statement LM2)**

The Governments of Tana River and Lamu Counties will establish a joint livestock registration scheme in order to provide more accurate information on the number of livestock and particularly cattle, being grazed within the Tana Delta at all times of the year.

#### **13.2.16 Establish a Livestock Committee**

Future management of livestock within the Tana Delta will require close cooperation between individual owners and herders and the regulating authorities. A formal committee should be established by the two county governments to provide this level of coordination and ensure that the regulations are acted on.

#### **13.2.17 Develop a Livestock Management Plan**

Effective use of the Delta for livestock grazing will depend in future on much better knowledge of the numbers of animals involved, the stocking densities and the capacity and suitability of different grazing areas. In order to guide decision-making a livestock management plan will be prepared.

#### **13.2.18 Establish a Livestock Wardening System**

Large numbers of livestock are driven into the Delta from outside areas during the dry seasons and there is a need to establish a community-based wardening scheme, assisted by the County governments, to check on livestock movements and numbers of animals so that appropriate action can be taken.

#### **13.2.19 Identify and Map Areas used for Flood Recession Farming**

Flood recession farming is a long-established tradition in the Tana Delta and provides valuable land and resources for food production, although it can also be damaging to nature conservation interests if the land is regularly ploughed and cultivated. More detailed information is needed on the areas and extent of flood recession farming and this will be collected during the preparation of rural development plans for the individual settlements.

#### **13.2.20 Survey the Main Rivers and Establish a 500 Metre Wide Corridor on the Two Main Rivers**

The river corridors are important for food production (vegetables and fruit), for nature conservation and as the principal points of access for livestock watering. Full surveys need to be undertaken on the two main branches (Oda and Matomba) of the River Tana in both the Upper and Lower Delta for planning purposes, including the

establishment of an enlarged protective buffer strip 500 metres wide.

#### **13.2.21 Identify Existing and Potential Watering Points for Cattle and undertake Consultation to Agree on Authorised access Routes for Livestock to Watering Points**

The river corridor surveys and mapping for individual Rural Development Plans will provide critical information to identify the main watering points and pinpoint areas of conflict between farmers and pastoralists.

#### **13.2.22 Undertake Topographic and Hydrological Surveys to identify Suitable Areas for Community-based Irrigation Schemes**

The focus of development agencies and international partners should be switched from large-scale commercial irrigation schemes, which have failed and caused serious hardship and environmental damage in the Tana Delta in the past, to small-scale community based projects – linked with private sector partners. A first step in initiating this more sensitive approach will involve accurate physical surveys of low lying areas adjacent to the main rivers where gravity fed or pumped irrigation schemes can be introduced to assist local communities to improve agricultural productivity.

#### **13.2.23 Establish a GIS Section within the County Planning Teams**

An urgent priority for both County Governments is to establish a properly staffed GIS unit with at least one fully qualified GIS specialist to work full time on surveying and mapping the resources of the Tana Delta.

#### **13.2.24 Set up a Monitoring Framework for Population Growth and Inward Migration**

A population advisory unit should be established to give advice on voluntary means of managing future population change and monitor the rate of inward migration to the Tana Delta which threatens its long term social structure and stability.

#### **13.2.25 Prepare a “Development Control” Scheme for the Delta, including all the Necessary Application and Decision Forms**

All of the procedures identified in this action plan and in other parts of the Tana Delta Land Use Plan will need to be supported with appropriate forms for recording applications and decisions on planning matters. The process of documentation needs to be undertaken by the Development Control team to be established in both County Governments.

#### **13.2.26 Set up a Land Use Plan Monitoring Unit**

A large number of activities need to be undertaken in order to make the LUP effective and this will require careful monitoring by both the staff of the County Governments and National Government, but also community representatives. It is proposed that one or more representatives of the Tana Planning Advisory Committee (TPAC) should be appointed to attend internal review meetings of the two County Governments to be held annually, and to report back to the full committee.

#### **13.2.27 Set up a Climate Change and Adaptation Unit for the Delta**

Significant long term changes are likely to occur in the Tana Delta as a result of global warming and it is therefore important that the latest evidence and policy advice is obtained and examined by the relevant authorities and the Tana Delta communities. The County Governments will appoint a small team to monitor issues relating to climate change.

# CHAPTER 14

## REVISION TO NATIONAL POLICIES

### 14.1 Introduction

Some of the findings in the Tana Delta Land Use Planning study point to the need for revision to national policies and this section makes recommendations for such work.

### 14.2 Water Resources

During the preparation of the Tana Delta Land Use Plan it was understood that the Japanese Aid Agency, JICA, has been funding a major review of water resources at national level although no details have been available (Government of Kenya, 2009).

Following publication of the findings of this review there will be a need for thorough investigation of all proposed development within the River Tana Basin to ensure that sufficient water can be abstracted and/or stored to meet future needs while maintaining the essential environmental reserve flows in the River Tana.

The Tana Delta Land Use Plan has identified the need to maintain a mean flow of 60m<sup>3</sup>/sec at Garsen and this will require recalculation of the available yield and timescales for meeting future water demands in the catchment.

### 14.3 Irrigation

National policies for irrigation have consistently underestimated the practical constraints on achieving successful projects which, in addition to hydrological limitations, have invariably involved weaknesses in management and coordination of physical schemes. The SEA accompanying the Tana Delta Land Use Plan has defined a number of precautionary principles that should be followed in the case of planning for all irrigation projects. These include the requirement that existing schemes should be fully evaluated and reinstated wherever practicable, before embarking on new projects. The two major schemes in the middle Tana catchment are located at Hola and Bura and should be fully restored and extended to their maximum potential before other options are considered.

### 14.4 Transport and Communications

Following the decision to promote the LAPSET corridor and Lamu Port there is an urgent need for the national government to review the status of the existing road from Nairobi through Garissa to Garsen, Malindi and Lamu. This road should be upgraded to a National route and given high priority for national support given its long-term importance to development of the Northern Coastal region.

# **PART TWO**

## TECHNICAL ANALYSIS

### SCENARIOS FOR DEVELOPMENT IN THE TANA DELTA TO 2050



# CHAPTER 15

## SCENARIO – BUILDING

### 15.1 Introduction

This chapter provides an introduction to the process of building three scenarios which helped to shape the Tana Delta Land Use Plan. It sets out the methodology for constructing the current situation (baseline) and individual scenarios.

**Chapter 16** contains a description of the baseline. **Chapter 17** describes Scenario A – the continuation of existing trends assuming continued development of traditional livelihoods. The next chapter, **18**, examines potential commercial developments in Scenario B while **Chapter 19** describes Scenario C, which is a hybrid of A and B and embraces the most sustainable options from both, within the constraints imposed by land and water resources. Each Scenario is assumed to begin in 2010 (or the closest year for which statistics are available: either 2011 or 2012), with projections to 2030 and 2050. These time horizons were recommended by the Netherlands Commission for Environmental Assessment. The first time horizon is twenty years on from 2010 and coincides with the development vision for Kenya (2030). The second horizon is a further twenty years on.

### METHODOLOGY

#### 15.2 The Planning Framework

Scenarios or alternative strategies are commonly used in planning studies in order to test the plan vision, goal and objectives and ensure that the most appropriate end solution is adopted. Three strategies were originally proposed in the Tana Delta Land Use Plan Framework. These were:

- A. Conservation-orientated strategy,
- B. Development strategy, and,
- C. Community-focused hybrid strategy.

The justification for examining each of these strategies was set out in the following terms:

**Conservation-orientated Strategy:** This strategy will work with the existing degraded environment and pattern of economic land uses within the Delta to secure major conservation gains. The process will examine where and what form of conservation or protection is required, where development should be avoided and what mitigation is required if development occurs.

**Development Strategy:** A conceptual model will be developed that accepts that all current land allocations – including those that are controversial and heavily disputed by sections of the local community – will eventually be allowed to proceed. This approach will consider what type, amount, form and location of development might be appropriate in the absence of environmental constraints.

**Community-focussed Hybrid Strategy:** This strategy will contain elements of both the conservation and development strategies. This alternative will consider the influence of governance, laws, policies institutional arrangements and capacity, human resource requirements and sustainable concerns to promote public dialogue.

#### 15.3 Re-definition of the Three Scenarios

After completing the Land Use Planning Framework, further discussion and debate by the LUP team followed on the development of scenarios at a workshop in Malindi (6-10 August 2013). An important conclusion arising from this workshop was that the use of the title 'Conservation-orientated' strategy was potentially divisive and likely to be misunderstood by local communities. This is due to the fact that previous measures to establish conservation areas were heavily criticised because they were perceived to have excluded the rights of local people, whether this was actually true or not (e.g. the establishment of the Tana River Primate National Reserve). For this reason the concept of a conservation-orientated strategy was dropped and was replaced with a strategy based on continuation of existing traditional practices which effectively represents a 'business as usual' or 'do-nothing' scenario. At the same time, the principles of ecological sustainability remain highly relevant since they underpin the Land Use Plan, vision and goals.

A further modification in the development of scenarios was the decision to base the development strategy on notional commercial development projects rather than actual examples. The reason for this change was to avoid provoking a debate about specific projects that might or might not come to fruition, and to allow the discussion to concentrate on the broad principles of what makes a commercial development project a fully sustainable and desirable outcome, and therefore worthy of inclusion in the development Plan.

Accordingly, the three scenarios that are described in this chapter consist of:

- A. Continued development of traditional livelihoods
- B. Commercially oriented development
- C. A sustainability- based hybrid

This chapter describes the basic characteristics of each scenario without attempting to evaluate whether the proposals could actually be achieved. The process of evaluation has been undertaken in the parallel Strategic Environmental Assessment (SEA).

## 15.4 Methodology for Constructing Scenarios

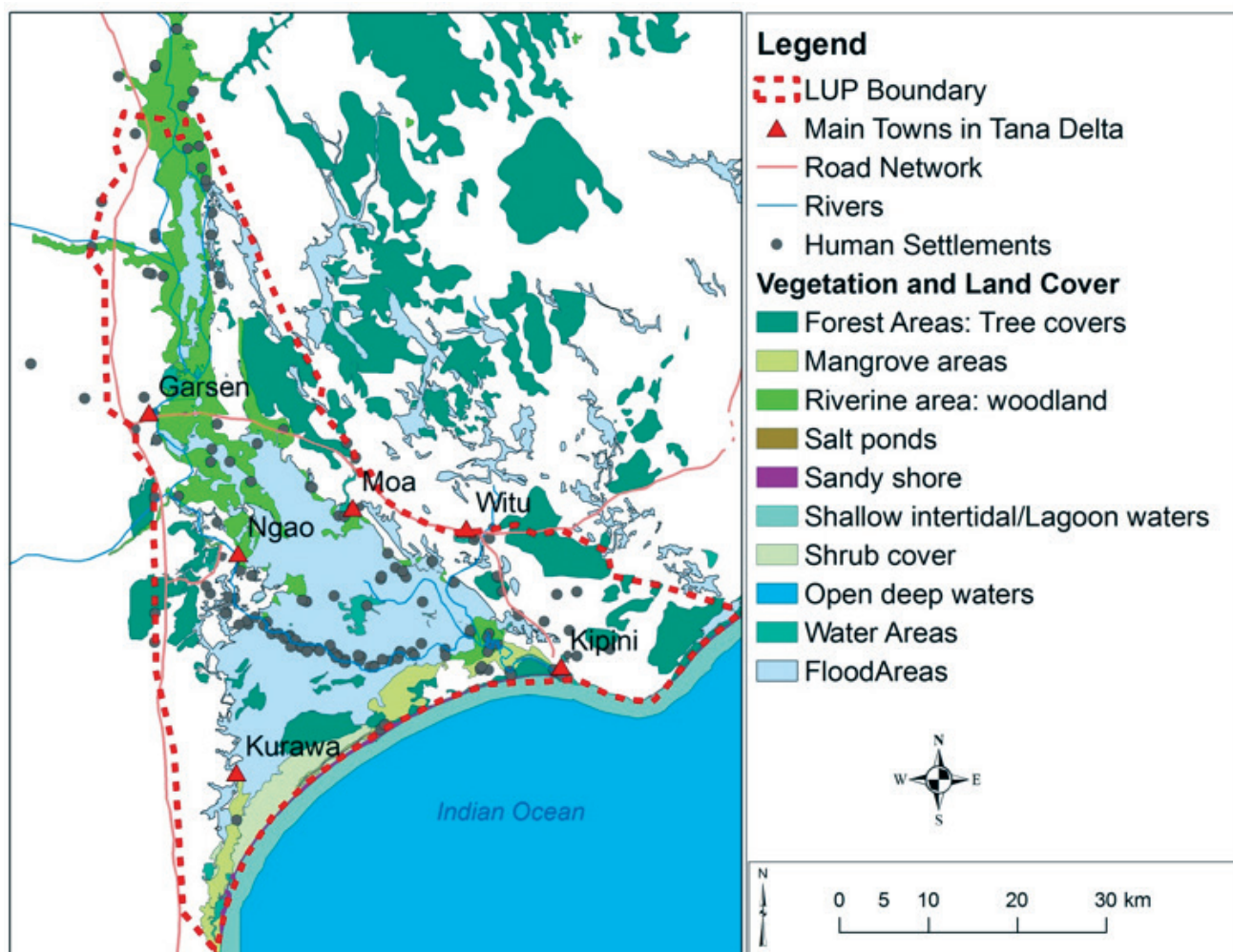
### 15.4.1 Establishing the Baseline

The first step in constructing scenarios of future conditions was to define the existing situation in the Delta in terms of “vegetation”, “land cover” and “land use”. These three terms need a brief introduction. “Vegetation” simply refers to the dominant type of Plant

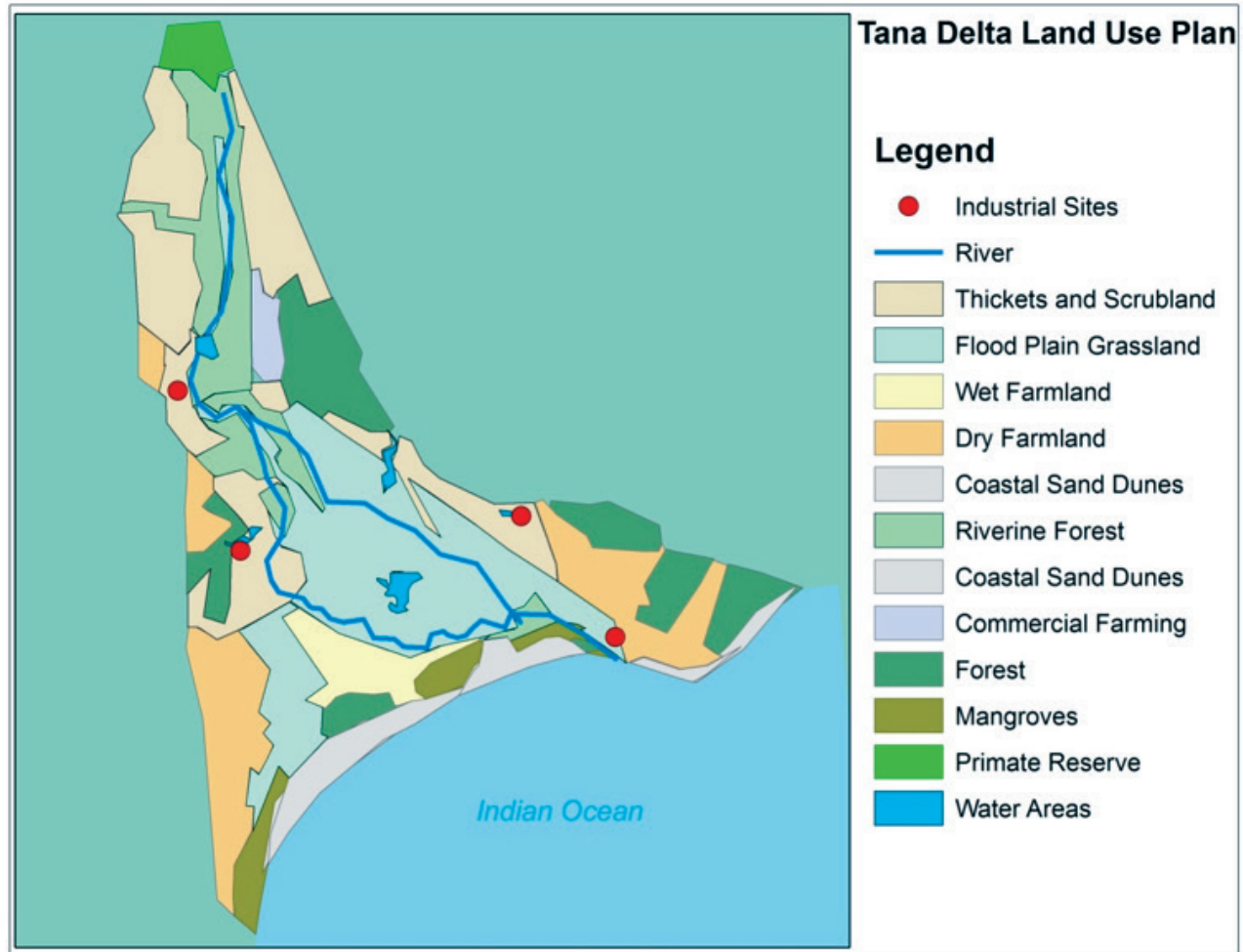
growth in an area (i.e. forest or grassland). “Land cover” may be vegetative in nature but here the term refers to the predominant physical surface such as ‘sandy shore’ or ‘water’. “Land Use” implies the principal form of human activity within a given area. The initial maps for the Delta, first prepared in 2010, show vegetation and land cover (See Figure 15.1).

**Figure 15.1** (vegetation and land cover) shows the extent of vegetation types that can be mapped from satellite imagery, including Google Earth, without needing detailed ground survey. However, a description of the terrain, as covered by ‘thicket and scrub’ or ‘floodplain grass and woodland’, can only convey an impression of the typical vegetation types. It does not help to determine what sort of land uses are taking place within these broad habitat types. For this reason, a second map, (**Figure 15.2**) supported by a detailed table, has been prepared which distinguishes a limited number of additional physical features or “land use classes”.

**Figure 15.1 Distribution of Vegetation and Land Cover in the Delta (2010)**



**Figure 15.2 Land Use Classes**



**Figure 15.2** differs from **Figure 1.1** “vegetation and land cover” in the following respects:

A distinction is made between “dryland” and “wetland” farming areas in **Figure 15.2**. Dryland farming areas correspond to areas shown in **Figure 15.1** as “cultivation with settlements” which lie on the terraces on either side of the Delta floodplain. Wetland farming areas are shown in **Figure 15.2** as a new land cover category and takes up a significant part of the lower Delta on both banks of the former course of the River Tana. These wetland farming areas have been created in recent years from land formerly classified as “floodplain grass and woodland” in **Figure 15.1**. A further distinction has been made in **Figure 15.2** between dryland and wetland farming as practised by communities and “commercial farming” practiced by TARDA. The area currently farmed by TARDA is shown in orange in **Figure 15.2**.

Four settlements are individually identified in **Figure 15.2** as Garsen, Tarasaa, Witu and Kipini. The dune systems along the coast (which underlie the coastal shrub vegetation, or have a surface consisting largely of

sand) have been identified separately in **Figure 15.2**. In all other respects the vegetation types used in **Figure 15.1** have been transferred to **Figure 15.2** but the areas have been simplified to make it possible to produce indicative areas which can then be compared in future scenarios.

#### **15.4.2 Definition of Vegetation Types and Land Use Classes**

The terminology in these scenarios is frequently used elsewhere but often has subtly different meanings in other reports. Therefore, in order to avoid scope for misunderstanding, the individual vegetation and land cover types and land use classes are set out below:

**Forest:** This applies to all areas of tree cover where the canopy is virtually or completely closed and the trees are located in relatively dry areas, which are only exposed to flooding in exceptional circumstances.

**Riverine Forest:** has the same meaning as ‘Forest’ except that the trees and other vegetation are adapted to

periods of immersion in standing water because they are situated within the floodplain and close to the River Tana or other main water course.

**Thicket and Scrub:** covers a wide range of habitats in which individual trees, stands of trees (thickets) and lower scrubby bushes are dispersed throughout variable terrain. Some areas are very dry whereas others may lie in depressions that accumulate standing water in the wet season. The underlying soils are usually poor and infertile. Ground cover consists of sparse grasses, especially where significant grazing takes place by wild herbivores or livestock.

**Mangrove:** applies to those intertidal areas where mangrove species predominate. In some cases the entire vegetation may consist of dense mangrove forest. In other areas, mangrove may only be established in small pockets but the general area will be conducive to mangrove invasion.

**Lake and Water Areas:** are permanent or semi-permanent fresh water bodies where the water depth precludes grazing for most of the year although the lake margins may retreat substantially in the dry seasons and in some cases the lake may dry completely in drought years.

**Salt Ponds:** are artificial enclosures that have been formed specifically to allow for evaporation and the harvesting of salt. These are found in the extreme southerly corner of the Delta.

**Sandy shore:** relates to the beaches which fringe the dune system along the coast and covers those areas that are immediately above the normal tidal range but are subject to inundation in storm conditions.

**Shallow Intertidal/Lagoon Waters:** These areas are generally submerged by saline water at high tide and hold water even at low tide.

**Urban Areas:** are settlements that have formal road layouts and are provided with the basic services of electricity and water. These features distinguish them from settlements where access tracks are informal and any services are minimal.

**Dryland Farming:** these land use areas coincide with the vegetation/land cover type 'cultivation with settlements'. They are typically found on better quality soils within the broad 'thicket and scrub' vegetation zones on the terraces. Usually the areas of cultivation are dispersed within areas of scrub and support one or more families who are either practicing shifting agriculture or are attempting to establish more permanent farmland

where water is accessible. Crops are rain-fed and often fail in dry years. Consequently, settlers often resort to charcoal burning and fuel wood collection as alternative or supporting livelihoods.

**Wetland Farming:** These areas are found within the floodplain of the River Tana and its laga tributaries. They are converted from existing grassland or swamp and wetland vegetation and may be temporary if land is cleared and cultivated immediately after the recession of floodwater, or permanent where the soils retain sufficient fertility as a result of annual flooding which spreads silt over the land.

**Commercial Farming:** TARDA reclaimed an area in the upper Delta as part of its integrated rice project in the 1980-90's and continues to manage part of this land as a commercial farming operation although the yields and milled production fall well short of the performance that would be required in a non-subsidised commercial operation. There are also two very small irrigation schemes run by communities of local farmers that might be regarded as commercial except for the fact that produce is intended largely for local use. In the development of the Scenarios 'Commercial' farming is taken to mean any agricultural operation which relies on sale of produce on the open market.

**Floodplain Grass and Woodland:** This term is used in the vegetation map to show all areas that are seasonally inundated by floodwater. The natural climax vegetation for most of these habitats includes extensive tree cover, but this has largely been cleared except along the riverbanks.

**Floodplain Grassland:** is used to describe those areas of the floodplain which are heavily grazed during the dry season by both wild herbivores and livestock.

### 15.4.3 Comparing Vegetation, Land Cover and Land Use

**Table 15.1** has been prepared based on the information shown in **Figures 15.1** and **15.2**. Its purpose is to show the comparison in surface area and overall percentages of individual land use classes. It should be noted that a new land use class "industry/warehousing" has been added in anticipation of its use in scenario building.

**Figure 15.3** and **Table 15.1** show those land use classes that can be physically mapped, but there are a number of economic activities which do not observe fixed boundaries and occur across a range of land use classes. These include cattle rearing, natural resource harvesting and charcoal and fuel wood production. To illustrate this point, cattle grazing is concentrated on the floodplain grass and woodland areas in the dry season



**Table 15.1 Comparison of Areas Occupied by Vegetation, Land Cover and Land Use Classes**

Vegetation and Land Cover	Area Km <sup>2</sup>	Land Use Classes	Area Km <sup>2</sup>	%age
Forest	271	Forest	271	12.0
Riverine Forest	323	Riverine Forest	323	14.4
Thicket and Scrub	400	Thicket and Scrub	400	17.8
Mangrove	84	Mangrove	84	3.7
Water Areas	18	Water Areas	18	0.8
Salt Ponds	5	Salt Ponds	5	0.2
Shrub cover	73	Dunes	103	4.6
Sandy Shore	30			
Cultivation with settlements	415	Dryland farming	370	16.4
		Commercial farming	31	1.4
		Urban Areas	14	0.6
		Industry / Warehousing	0	0.0
Floodplain grassland	631	Floodplain grassland	508	22.6
		Wetland Farming	123	5.5
Shallow intertidal/lagoon waters	Not recorded			
<b>Total</b>	<b>2250</b>		<b>2250</b>	<b>100</b>

Source: Tana River Delta Land Use Plan, 2014

**Figure 15.3 Land Uses and Main Economic Activities**

Land Cover and Land Use	Area (Km <sup>2</sup> )	Cattle Grazing	Communal Farming	Fishing	Natural Resource Use	Charcoal & Fuel Wood	Tourism	Commerce & Industry	Urban Development
Forest	271	○			●	●	●		
Riverine Forest	323				●	●	●		
Thicket and Scrub	400	●			●	●	●		
Mangrove	84				●		●		
Water / Lakes	18			●			●		
Salt Ponds	5								
Dunes	103				○		●		
Urban areas	14						●	●	●
Dryland farming	370	○							
Wetland Farming	123	○	●						
Commercial farming	31		●						
Floodplain grassland	508	●					●		



but moves into the thicket and scrub zones in the wet season. Similarly, natural resource use takes place across a range of vegetation/habitat areas depending on the nature of the material being harvested; grass and reeds for thatching are exploited on the floodplain; fuel wood and timber for charcoal burning are also exploited in floodplain woodlands, but large amounts of the biomass also come from dry thickets and scrub and from both riverine and other forest areas.

**Figure 15.3** shows diagrammatically how some economic activities take place across different land use zones. For obvious reasons it is impossible to attribute precise areas to these activities. In evaluating the information contained in **Figures 15.1, 15.2, and 15.3** and in **Table 15.1** it is important to bear in mind that each form of presentation is inevitably an over-simplification of conditions on the ground. This is because the pattern of land use within the Tana Delta is very variable and changes according to season.

#### 15.4.4 Building the Scenarios

Two scenarios have been built on a set of common assumptions; these are **Scenario A** (Continued Development of Traditional Livelihoods) and **Scenario B** (Commercial Development).

In **Scenario A** the baseline position has been extrapolated to show what the effects of increasing population (from natural increase and inward migration) might be by the two threshold dates of 2030 and 2050. Extrapolation has involved establishing the numerical ratios between existing population and the areas of land used for specific purposes and then calculating the pro rata increase or decrease according to future population levels.

**Scenario B** (Commercial Development) takes as its starting point the assumptions relating to growth of population and an economy based on traditional livelihoods as shown in **Scenario A**. It recognises that future development will need to be planned to fit the actual circumstances prevailing in the Delta at any given time, including the number of people, settlements and demand for natural resources. In addition, however, **Scenario B** anticipates a number of commercial development opportunities that have been selected objectively from an analysis of development prospects in the region.

No attempt has been made to factor other considerations into the construction of either scenario – such as the availability of water or anticipation of future conflicts over resources, so neither scenario represents a viable end-state but simply indicates the direction of potential growth. Analysis of consequences is undertaken separately in the SEA.

A third Scenario (C) – the Hybrid – has been developed by selecting the most sustainable components of Scenarios A and B and is based on the findings of the SEA analysis.

#### 15.4.5 Description of Economic Activities

The process of generating descriptions of the nature and scale of potential activities in the Tana Delta has been very challenging; it has been necessary to collect enough information to give a clear picture of the nature and scale of development on the one hand, but also important to avoid over-complicating the analysis of what is basically an exercise in crystal ball gazing into the future. Consequently it is important to stress that the individual descriptions of economic activity provide only one snapshot view of the multiplicity of end-states that could be reached in 20 to 40 years time. However, by combining the many different facets of land use, economic and social change the authors believe it is possible to sketch out the challenges and opportunities for the Delta and its communities in a realistic manner and to provide sufficient material to inform a proper debate about the directions in which future land use planning should go.

In describing individual scenarios, an attempt has been made to describe four essential characteristics, these are:

The **area and extent** of the development or land use activity under consideration. This has been done in words and by giving a notional area in square kilometres (1 km<sup>2</sup> = 100 hectares). The area figures are notional in the sense that there are a large number of variables which determine how much land is needed for any activity and these can only be treated in a simplified way within each scenario.

The **number of people** affected in terms of **livelihood and employment**. Again, the figures are only approximations and try to take into account both the gains in livelihoods /employment from any specific land use or economic activity but also losses, where existing users are displaced or have to be resettled.

**Water Demand** based on typical levels of consumption for the activity under review. Two types of estimate are given; the first is the annual consumption in millions of cubic metres (million m<sup>3</sup>). This figure can then be related (in the SEA analysis) to the gross yield of the River Tana which is of the order of 5-7 billion cubic metres a year (5000-7,000 million m<sup>3</sup>). The second estimate is based on the water demand for the particular activity over a given period of time (for example, the amount of irrigation during the 135 day growing season for vegetables) expressed as the equivalent number of cubic metres per second flowing down the River Tana. So, for example, irrigating 10,000 hectares of rice would require

reserves of 70 million m<sup>3</sup> of water in a year, but the concentration of this demand into a 150 day growing season would need most of this water to be available at the height of the dry season, necessitating the diversion of around 20,000 m<sup>3</sup> of water a day or 5.4m<sup>3</sup>/sec from the River Tana.

Value of Production has been indicated in a very simple way as the gross turnover of a business or the market price for a commodity. This assessment does not attempt to examine the costs of production, inputs, gross margins or any of the other economic indicators that are needed to assess the efficiency or profitability of the business enterprise. Its purpose is only to show the relative scale of the economic investment and, by inference, the level of

return that might be expected. For each of the scenarios, economic costs have been attributed from local sources where these are available. This has made it possible to generate a figure of around 50-60% of the value of the local economy. However there are some sectors for which local data is not available including infrastructure development, transport, construction, and public and professional services. In order to incorporate estimates for these sectors the local economy figures have been scaled up using the same proportions that the missing sectors make to the national economy, as measured in the 2011 National Accounts.

Tables 15.2- 15.4 illustrate the process for Scenario A data.

**Table 15.2 Contributions to Gross Domestic Product in 2011 (National Accounts) 1**

National Accounts figures 2011				
Sector			KSh Million	%age GDP
Agriculture and forestry			323,465	21.0
Fishing			5,891	0.4
Mining and Quarrying			7,246	0.5
Manufacturing			147,989	9.6
Electricity and water supply			32,465	2.1
Construction			53,713	3.5
Wholesale and retail trade repairs			166,205	10.8
Hotels and restaurants			20,792	1.4
Transport and communications			190,382	12.4
Financial intermediation			65,095	4.2
Real estate, renting and business services			80,888	5.3
Public administration and defence			48,270	3.1
Education			90,873	5.9
Health and Social work			32,896	2.1
Other Community services			55,988	3.6
Private households (employment)			4,517	0.3
Less financial services indirectly measured			-11,843	-0.8
Taxes less subsidies			224,474	14.6
GDP			1,539,306	100

**Table 15.3 Elements of the Economy Estimated from Available Local Data**

<b>Economic Value Scenario A</b>				
	<b>2010</b>	<b>2030</b>	<b>2050</b>	<b>%</b>
Open Grazing	4200	4200	4200	
Ranches	3	386	772	
Commercial Farming	203	393	826	
Subsistence Farming	183	309	557	
Fishing	53	65	89	
Bees	24	72	180	
Natural Resources (NTPF)	80	134	242	
Traditional Building	100	169	305	
Charcoal and Firewood	195	397	714	
Tourism	26	50	75	
Trade	94	0	0	10.8
Finance	0	0	0	4.2
Infrastructure Transport	0	0	0	12.4
Industry / Manufacturing	257	257	257	
Construction	0	0	0	3.5
Admin Educ Health	0	0	0	11.1
Water	0	0	0	2.1
	<b>5418</b>	<b>6432</b>	<b>8217</b>	<b>44.1</b>

Method: Elements of the local economy estimated from local data amount to KSh 6,962 million in 2050. This represents 56.2% of the overall local economy (based on equivalent data for the National Economy). Each of the missing elements (shaded grey) is estimated, pro-rata, and incorporated in a final table (15.4)

#### 15.4.6 Levels of Accuracy

Scenarios spanning time horizons of 20 and 40 years must inevitably be based on very wide ranging assumptions and there is no sense in which they can be regarded as giving an accurate picture. Instead their purpose is to illustrate likely trends.

Many calculations have been employed in building up each scenario. In each case the exact figures resulting from the calculation have been used – even though this may appear to give an unrealistic level of accuracy. However, rounding and averaging results would have made the task of cross-referencing between the three scenarios more difficult so the reader should bear in mind that all figures are no more than very general approximations.

#### 15.4.7 Use of Information Contained in the Scenarios

All of the information that has been included in the description of the scenarios has been assembled for the specific purpose of projecting future change in the Tana Delta. This has been done by taking firm information about the Delta wherever possible and extrapolating to 2030 and 2050. The results have also been tested by comparing findings from other published studies, as a form of triangulation, and have been found to be broadly compatible for the purpose of this assessment. While the resulting descriptions are regarded as sufficiently accurate to meet the needs of the Land Use Plan and SEA they should not be transposed to other studies without first checking the validity of the underlying assumptions.

**Table 15.4 The Completed Model of the Local Economy for Scenario A in 2050**

<b>Economic Value Scenario A</b>				
	2010	2030	2050	%
Open Grazing	4200	4200	4200	28.6
Ranches	3	386	772	5.3
Commercial Farming	203	393	826	5.6
Subsistence Farming	183	309	557	3.8
Fishing	53	65	89	0.6
Bees	24	72	180	1.2
Natural Resources (NTPF)	80	134	242	1.6
Traditional Building	100	169	305	2.1
Charcoal and Firewood	195	397	714	4.9
Tourism	26	50	75	0.5
Trade	94	1243	1588	10.8
Finance	407	483	617	4.2
Infrastructure Transport	1202	1427	1823	12.4
Industry / Manufacturing	257	257	257	1.7
Construction	339	403	514	3.5
Admin Educ Health	1076	1277	1632	11.1
Water	204	242	309	2.1
	8646	11506	14699	100.0

# CHAPTER 16

## EXISTING SITUATION (Conditions in 2010)

### 16.1 Introduction

This description of the baseline conditions provides a summary of salient facts drawn from the SEA Baseline Report (Odhengo et al, in press) and LUP Baseline Report (Odhengo et al, in press). The full reports should be consulted for a detailed account of existing conditions in the Plan Area. It is important to note that the 'Plan Area' refers to two distinct areas. These are :

1. **"the Delta"**, which includes the Upper Delta between the Tana River Primate Reserve and Garsen-Witu Road and the Lower Delta which extends from the Garsen -Witu Road to the sea; the Lower Delta coincides very closely with the boundaries of the Ramsar site designation. and,
2. The **"buffer zone"**, which includes all rangeland extending up to 20 kilometres from the boundaries of the Delta.

The main focus of attention is on the Upper and Lower areas of the Delta, where future land use, social and economic changes are likely to have the greatest impact on the Delta's biodiversity, but some land uses – particularly grazing and charcoal burning – make extensive use of the buffer zone as well. Consequently some of the policies that are developed in the Land Use Plan will need to pay particular attention to these characteristics.

### 16.2 Population

The population of the Delta (as opposed to the wider area of the Buffer Zone) is estimated to be 102,000, with 65,000 living on the drier terrace areas, 35,000 people living in the floodplain and fewer than 2,000 people living on the coast (Odhengo et al, 2014b).

### 16.3 Economic Activity

The main livelihoods, as recorded in the LUP Framework Report, are based on:

1. Livestock rearing
2. Farming
3. Fishing
4. Bee-keeping
5. Harvesting of Natural Resources
6. Tourism
7. Trade
  - Wholesale and Retail
  - Commerce and Financial Services

8. Mining & Industry
  - Mining and Quarrying
  - Manufacturing
9. Infrastructure
  - Services
  - Transport
10. Administration and Professional Services
11. Urban Areas
12. Water
13. Nature Conservation

### 16.4 Livestock

#### 16.4.1 Area and Extent

Livestock rearing and management occurs throughout the Plan Area with cattle, goats, sheep and a small number of camels being grazed in open grassland, scrub, thicket and forest margins and on agricultural land after crops have been harvested. There are no accurate statistics for the numbers of animals kept by each household and, in practice, numbers vary from one or two cattle for poor families to many thousands held by extremely rich individuals. For comparative purposes in examining different scenarios, the number of livestock has been divided by the number of estimated pastoralist households in 2010 (9,942) (Odhengo et al, 2013) to produce average figures of livestock per household (9,942). The results are shown in **Table 16.1**.

**Table 16.1 Number of Animals per Household (2010)**

Animal	No. Recorded	Animals / Household
Cattle	211858	21.3
Sheep	131154	13.2
Goats	118676	11.9
Camels	360	0.036

**Cattle rearing:** The estimates for the number of cattle per household generated in **Table 16.2** have been compared with the findings of a survey of cattle keeping practices by the Orma in the Tana River District (Irungu, 2000). This study involved in-depth interviews with 48 headmen (25 Orma, 21 Wardei and 2 others). Although the study is more than 12 years old the characteristics and cultural practices of the communities are unlikely to have changed significantly in the intervening years. The average number of cattle held by each Orma household was 124 while the average for Wardei households was



192, with an overall range between 10 and 500 per household. Even these figures were described by Irungu as likely to be under-estimates because “Most of the pastoralists were reluctant to give the exact number of cattle under their ownership. They indicated that counting the cattle was likely to bring them bad luck. Livestock were counted only in preparation for zaka (tithe)”.

If the averages identified in this relatively small sample of 48 are applied to the 9927 pastoral households in the whole of the Tana Delta, this would suggest that there are between 1.23 and 1.9 million head of cattle. This figure is greatly in excess of the generally accepted estimate for the maximum number of cattle in the Delta which is quoted as 600,000 in the Tana Delta Conservation and Development Master Plan (Nature Kenya, 2010). This figure was based on data collected by Ministry of Livestock, Tana River Delta District.

Another source of information based on actual counts is provided by (Temper, 2011) who undertook a survey of Bandi village (close to Hewani), an Orma settlement of 204 houses comprising 1000 people, and arrived at an average of 50 head per household, while (Luke, 2005) concluded that the average number of cattle per household in Orma villages was around 100.

An important consideration in reviewing this evidence is the tendency for the ‘average’ representing the sum of all values divided by two, to skew numbers in favour of the relatively few very large herds of over 500 animals. Mean figures may give a more accurate guide to the total number of cattle but these are not readily available, although Temper notes that the mean for her data set was 15 animals per household compared with the average of 50. The range of estimates for the number of cattle in the Delta is shown in **Table 16.2**.

It is not possible to determine the absolute number of cattle in the Tana Delta which varies seasonally and with the inward and outward migration of herds, but it is clear that the number is significantly higher than the estimate

in **Table 16.1**. Taking the official district figures and grossing these up for the Delta gives what is regarded as the lower estimate for the number of cattle in the wet season of 213,000 head. In the dry season, the potential number of cattle may rise to between 497,000 and 1.9 million according to the different estimates shown in **Table 16.2**. The highest figure appears unrealistic, so averaging the four remaining estimates (222,858; 497,125; 994,250 and 1.23 million) generates a figure of around 735,000.

The LUP/SEA calculations are accordingly set in the range of **a base level of 220,000 head rising to 735,000 cattle at peak**.

**Grazing Areas:** Cattle, other livestock and wild herbivores graze all accessible areas of the Tana Delta and the buffer zone. The only areas that receive little or no grazing include dense forest, permanently flooded swamps, mangrove and other impenetrable habitat, amounting to between 5-10% of the Delta. Farming areas receive very low levels of grazing unless crops are invaded during droughts or farmers allow grazing to introduce manure to fallow areas (Odhengo et al, 2014a).

Thicket and scrub are invariably heavily grazed, especially in the dry season, but the slow growth rates of shrubs and grasses, due to dry and infertile soils, means that the nutrition values are low. The principal grazing areas are found on the wet grassland within the flood plains, amounting to between 70,000 and 100,000 hectares (depending on rainfall variation and the extent of flooding from year to year).

In order to provide a ‘constant’ for measuring the relative performance of each scenario the figure of 220,000 cattle grazing 100,000 ha of floodplain at the start of the dry season has been used to create a standard of 2.1 cattle per ha in the rich wet grasslands and scrub of the floodplain. For thicket and scrub areas within the Delta and also the buffer zone, the standard of 1 head of cattle per three hectares has been adopted.

**Table 16.2 Sources of Information on Cattle Numbers in the Delta**

Sample size	Average per household (HH)	Grossed up to cover the Delta (9942 HH)	Source
District statistics	21	222,858	LUP Baseline
48 HH	124, Orma 192 Wardei	1.23-1.9 million	Irungu (2000)
100 HH	50 Orma	497,125	Temper (2011)
Not known	100 Orma	994,250	Luke (2005)

Cattle play a dominant role in livestock rearing in the Tana Delta but other livestock including sheep, goats and camels are also significant grazers. In order to standardise grazing pressure amongst different herbivores, the convention of Tropical Livestock Units (TLU) has been adopted, under which a mature camel is given the score of 1; a typical cow or steer is 0.7, while sheep and goats score 0.1 each (Odhengo *et al* 2014a). With a mixed herd or flock of animals the overall number of TLU can be arrived at by summing individual scores. So, a group of five camels (5), twenty cattle (14) and 100 sheep and goats (10) represents 29 TLUs.

#### 16.4.2 Water Demand

The cattle found in the Tana Delta include Zebu and Boran breeds which are adapted to the often harsh and arid conditions (Odhengo *et al*, 2014a). These animals can survive for extended periods with very little water although they rapidly lose condition (Odhengo *et al*, 2014a). Normal daily intake when water is available is 12-20 litres for bulls and steers. Lactating cows require substantially more. Sheep and goats require less than ten per cent of the intake of cattle (Odhengo *et al*, 2014a). Based on these figures, water demand in the wet season would be around 3.5 – 4 million m<sup>3</sup>. Consumption in drought conditions probably exceeds 11,000 m<sup>3</sup> /day when the full complement of 735,000 cattle is in the Delta.

#### 16.4.3 Employment and Livelihoods

Employment Income: Irungu (2000) notes that the majority of cattle owners pay herders (men and boys) in kind rather than cash, so a herder will typically receive a castrated male, a calf or more rarely, a cow once a year – or a proportion of the milk produced. The only reference which has been found to direct cash income is a figure quoted in the Management Plan for Arabuko-Sokoke Forest (2002) which is KSh 24,874 per ha for rearing animals. This is assumed to relate to sedentary livestock rearing. It has been assumed for the purposes of the scenarios that one full time herder is required for every 100 head of cattle, although in practice the number of youths and young boys accompanying herds varies greatly since it is part of the way of life.

#### 16.4.4 Economic Value

**Cattle sales:** In terms of marketing, Irungu's survey (2000) provides the most detailed information. The total herd owned by the 48 households is assumed to be 7,380 based on the averages quoted. In the year preceding the survey 412 animals (6% of the stock) were purchased at a cost of KSh1.77 million while 726 animals (9.8% of the stock) were sold at a price of KSh14.4 million. The increased value (through fattening and maturing) amounted to KSh12.63 million or KSh1,711 per head for each animal in the herd.

If this level of trading (i.e. buying in young stock to fatten and strengthen the gene pool and selling mature animals) applied throughout the Tana Delta this would suggest an annual turnover (from trading alone) of KSh1,258 million (14.8 million USD).

Another approach for assessing cattle trading activity in the Delta is to examine figures for livestock sales at the Garsen Division markets (Odhengo *et al*, 2013). In 2009, the total number of cattle sold was 19,028 (Odhengo *et al*, 2013). At an average market price of KSh12,000 this represents a turnover of KSh 228 million. Livestock and meat prices vary significantly between seasons and during drought conditions.

There is clearly a significant gap between these two figures for trading output (1.26 billion compared with 228 million) but it must be recalled that the Ormas' primary interest in cattle has deep seated cultural roots and there is a strong reluctance to sell animals or to slaughter them except for wedding feasts and funerals. Consequently the first figure, at over KSh1 billion, may indicate internal trading within the Delta designed to increase the size of herds, and increase ownership even amongst the poorest households, while the second represents the off-sales for exporting animals to outside markets. Nature Kenya (2008) calculated that the 200,000 cattle that graze the area of the floodplain considered for sugarcane production have a market value of KSh 1 billion while the grazing value of this area exceeds KSh100 million.

**Milk production:** The average yield per lactating cow is around 1.8 litres a day in the Delta and 1.0 litres in surrounding areas (Irungu, 2000). Milk is retained either for feeding calves or for family consumption and a relatively small surplus is sold. The 48 households in the survey kept an average of 12 milking cows yielding 19.5 litres for human consumption. With a mean of 17 members per household this provided 0.5 litres per person per day. Friends or relatives received 1.2 litres per day leaving 2.8 litres for sale. The figure for human consumption of 0.5 litres per day per person is confirmed by Temper (2011).

On the basis of the figures quoted above, sales of milk from 9,927 households would amount to around 27,795 litres a day with a value of KSh834,000 at a farm gate price of 30Ksh.

**Sheep and Goats:** These animals play a vital role in food supply to households in the Tana Delta and surrounding rangelands because they can tolerate drier conditions than cattle and survive on less productive vegetation. In 2006, a total of 4,670 sheep and 5,377 goats were sold from Garsen Division, representing a value of KSh

20-30 million (Odhengo *et al*, 2013). This figure grossly undervalues the number of sheep and goats bartered within the communities on a day to day basis without involving traders and formal markets.

**Ranching:** Five of the major ranches in the region lie within the Delta Plan Buffer Zone, two of which extend into the core area on the terraces between Idsowe and Tarasaa. A sixth ranch lies wholly within the southern floodplain. According to the LUP Baseline Report (Odhengo *et al*, in press) the ranches were established to encourage local communities to get involved in modern livestock production and development on a commercial basis. However, the plan to transform these parcels of land from subsistence production to commercial ranching has not been successful. Apart from Ida-sa-Godana, which has some cattle; the resident communities on the ranches have reverted to non-commercial pastoralism based on goats and sheep. Ida-sa-Godana is currently grazed with a small number of cattle (240), goats (112) and sheep (128).

## 16.5 Farming

### 16.5.1 Area and Extent

Statistical information on farming comes from the former Tana Delta District Development Plan (2008-2012). This covered a very much larger area than the Tana Delta including all of Garsen Division which lay largely outside the Delta and much of the Buffer Zone. The two divisions with information relevant to the core of the Delta are Tarasaa and Kipini covering an area of 1600 Km<sup>2</sup> compared with the area included within the Delta Plan of 2,250 Km<sup>2</sup>. The figures quoted for Tarasaa and Kipini in the LUP Baseline Report (Odhengo *et al*, 2013) have been scaled up to produce a more accurate spatial assessment. Based on this analysis a new table has been

formed to give spatial dimensions for agriculture in the Delta (see Table 16.3).

This analysis suggests that roughly half the Plan area (48%) could be regarded as suitable for arable farming land (equivalent to cultivation with settlements) or rangeland (equivalent to thicket and scrub). Although the potential for farming may be as high as 50%, this must be compared with the current level of arable and cultivated land which is shown as less than 25% in Table 16.3.

The remaining half of the Delta consists of a variety of natural and semi-natural habitats (forest, riverine forest, wet grassland, marsh or open water). However, in practice, it is likely that all but the most impenetrable areas of forest or wetland are modified by grazing at some time or other by livestock and wild animals, or are exploited for natural materials by the local communities.

#### 16.5.1.1 Area and Types of Farming

Farming practice includes permanent arable and fruit growing areas around settlements, small irrigated areas, temporary slash and burn for rain-fed cultivation, and areas of flood recession farming where land is planted after the flood waters have receded. These areas cannot be mapped with precision from air photographs and satellite imagery without very high levels of investment in data and analysis coupled with confirmation of the results by ground truth surveys. For the purposes of this study, the areas of farmland have been identified from existing maps and by interpreting land cover as displayed on 'google earth'. The results are shown in Table 16.3.

The area currently farmed (wet and dry farming) or covered by thicket and scrub and equivalent to rangeland is estimated from mapping sources to be

**Table 16.3 Recalculation of Farming Areas in the Tana Delta**

ITEM	TARASAA	%age	KIPINI	%age	TOTAL	%age	Scaling Up %	Add Area	New Total
AREA (Ha)	83800		71400		155,200		69800	69800	225,000
ARABLE (HA)	5,902	7	28,092	39.3	33,994	21.9	7	4886	38,880
CULTIVATED (HA)	1,110	1	4,219	5.9	5,329	3.4	1	698	6,027
IRRIGABLE (HA)	2,867	3	834	1.2	3,701	2.4	0	0	3,701
NEED DRAINAGE (HA)	3,672	4	2,256	3.2	5,928	3.8	4	2792	8,720
DRAINED (HA)	0		0		0		0		
RANGELAND (Ha)	23300	27.8	10000	14.0	33,300	21.5	27.8	19404.4	52,704
Subtotal	36,851		45,401		82,252	53.0		27780.4	110,032
Unaccounted for (Ha)	46,949		25,999		72,948			42019.6	114,968
Farm/Range land as a %age of total		44.0		63.6		53.0			49

89,300 hectares which represents 39.7% of the total. In practice parts of the floodplain grassland could also be converted to temporary farmland which would raise the percentage above 40%. These figures may be compared with the figure quoted for the Tarasaa district of 44%, or the figure of 53% generated by including the more fertile and heavily cultivated area of Kipini district, and the overall summary of 49% in **Table 16.3**.

For the purpose of building scenarios a mid-range figure of 45% has been adopted.

#### 16.5.1.2 Subsistence Cultivation

Taking the derived estimate for the area in permanent cultivation (6,147 hectares) and dividing this by 19,885 which represents the number of households present in the Delta in 2010, generates a figure of 0.3 ha (0.75 acres) per household. This calculation makes no allowance for the fact that most Orma settlements have fewer areas of permanent cultivation by comparison with the Pokomo villages (although this situation is changing quite fast). The population is split roughly 50/50 between the two ethnic groups (44% Orma, 44% Pokomo; 12% other) so if the number of households holding cultivated land is halved, the average distribution per household of cultivated land becomes 0.6 hectares (1.5 acres). These estimates can be compared with a survey undertaken of 9 households in Vumbwe, a Pokomo village adjacent to the TARDA Rice irrigation project area, which recorded an average of 2.2–3 acres (1ha) per family, ranging from half an acre to 4 acres per household (Temper, 2012). For the purposes of developing the overall baseline and scenarios a figure of 1.5 acres has been adopted as the average land holding per household.

#### 16.5.1.3 Fruit Farming

Existing fruit production is based on harvesting from indigenous forest trees and small river-side plantations owned by individual households. Production has declined dramatically in recent decades due to lower water levels in the River Tana. Mango trees originally produced 5000<sup>1</sup> fruits per tree. This has dropped to less than 500 on average. Banana Plantations have also been reduced in size (Diwayu pers comm).

#### 16.5.1.4 Food Relief

It is important to note that the population in the Tana Delta is not self-sufficient in food. For much of the year, food relief is provided to between 10-15% of the population under the Government's PRRO/Food for Assets programme. In times of flood or drought this

proportion rises and in June 2012, for example, 15,700 people in the Tana Delta were given food out of the total distribution to 63,372 people in Tana River County (National Drought Management Authority, 2012).

### 16.5.2 Water Demand

Two irrigation schemes are operational within the Tana Delta, namely TARDA's integrated rice project and the Hewani and Wema settlement irrigation scheme as shown below in **Table 16.4**. Actual production data is not available so average figures for production within the former Tana Delta District have been used to complete the table.

**Table 16.4: Irrigation Schemes**

IRRIGATION SCHEME	CROP	AREA (ACRES)	PRODUCTION <sup>1</sup> (Tonnes)	VALUE (USD)
TARDA	RICE	200	297.5	226,100
HEWANI & WEMA	RICE	135	200.8	152,608

The chequered history of the TARDA rice project has been described in the SEA Baseline Report (Odhengo et al, 2012c ) and although production levels and yields have improved in recent years the project has suffered in the past from repeated damage and erosion from flooding, poor management, inappropriate application of inputs and poorly maintained machinery.

Hewani (and Wema) irrigation schemes are operated by the communities with a total membership of 283 individuals, although 3000 people depend on rice production for their main sustenance<sup>2</sup>.

### 16.5.3 Employment and Livelihoods

Subsistence farming is geared entirely towards providing food for the households involved, although small amounts of produce are traded or bartered for other provisions within each settlement. Casual labour is provided by all active household members at harvesting and other busy periods but the number of permanent jobs/livelihoods supported is calculated on the basis that two (female) members of each household are engaged full time in tending their holdings.

### 16.5.4 Economic Value

There are no national economic statistics for sub-areas the size of the Tana Delta, but taking the 2010-2011 crop production data for Tana Delta from the LUP Baseline Report, the gross value of certain crops has

<sup>1</sup>This figure relates to old trees of indigenous varieties that grow to great size and are much larger than the new imported varieties bred for use in orchards.

<sup>2</sup>Wema and Hewani Villages Business Plan; Nature Kenya, April 2012

**Table 16.5 Summary of Farming Information in 2010**

Description/Year	2010
Population	102000
All Households (5.2 occupants)	19885
Number of Farming Households	9927
Land Area (Ha) at 1.5 acres/HH	6,204
FTE Jobs/Livelihoods	12,409
Value of agricultural production KSh million (at 2001 prices)	62

**Table 16.6: Estimate of Crop Values in 2010-2011**

CROP	AREA (HA)	PRODUCTION- (90kg bags) /Tonnes	YIELD / Hectare (Tonnes)	PRICE USD / Tonne	GROSS VALUE
MAIZE	4,043	(39,919) / 3592	0.9	217	779,464
RICE	1,680	(66,626) / 5996	3.6	760	4,556,960
COWPEAS	899	(4,815) / 433	0.5	664	287,512
GREENGRAMS	635	(7,441) / 670	0.95	820	549,400
CASSAVA	79	6,940 Tonnes	87.8	111	770340
COTTON	1,086	1,599 Tonnes	1.5	1,823	2,913,378
TOTAL	7,336				9,857,054

Source: Production figures (DAO, Tana Delta); Value (FAOSTAT/LUP/SEA estimates)

Note: Data on GreenGram prices from the Tana Delta Research Team average 470-1170 USD according to season.

been calculated using Food and Agriculture Organization (FAO) national statistics for Kenya (See **Table 16.6**). There is some discrepancy between the area shown under crops in **Tables 16.3** and **16.6**, but the two sets of figures lie within the same order of magnitude and have probably been compiled from different surveys. Average value of crops per hectare emerges as 1,334 USD.

The Management Plan for Arabuko-Sokoke Forest quoted farmers' earnings as KSh 10,007 per hectare for crop production in 2001. Taking the average of 1.5 acres per household for 9927 households (equalling 14,890 acres / 6204 Ha) in the Delta gives an a gross income, at 2001 prices, of KSh 62 million. Allowing for inflation at 5% per annum this yields an equivalent figure of KSh 96 million in 2010.

An alternative way of estimating the value of food produced for subsistence is to apply the nominal 'income' of 1 US Dollar a day per household to the farming community within the Tana Delta and assume that 60% of this is spent on food which is equivalent to KSh18,400 a year. The results are shown below and suggest a higher value of KSh183 million may be more appropriate.

Assessment Criteria	2010
All Households in Delta	19,885
Farming HH in the Delta	9,943
Nominal value of food produced KSh Million	183

## 16.6 Fishing

### 16.6.1 Area and Extent

Fishing is an important source of food and protein for many families in the Delta, but especially the Luo community who introduced improved fishing skills to the area. Fishing takes place in coastal waters, the main river and subsidiary channels and open water bodies including ox-bow lakes (former river meanders cut off from the main channel). In addition, aquaculture is being introduced, involving rearing of fish in both natural and artificially constructed ponds. **Table 16.7** shows the average annual production by species in 2007.

**Local marine fisheries are limited to waters close to shore, while foreign fishing fleets catch more valuable fish further out to sea.**



**Table 16.7: Fish Types and Production**

FISH TYPE	CATCH/ PRODUCTION (Kg)
Tilapia	76,601
Clarias	159,549
Protopterus	63,060
Cat fish	44,992
Marine species	221,168
Others	46,621
Total weight	613,003
Total value (Ksh)	53,136,500

Source: District Fisheries Office, Tana Delta 2007

### 16.6.2 Water Demand

Good quality water is essential to maintain healthy fish populations in the river channels and ox-box lakes within the Delta. Unfortunately, conditions have deteriorated over the last four decades with the building of dams in the upper catchment of the River Tana. In particular, the reduction in seasonal flooding has severely affected fish breeding since fish spawn in shallow waters.

Marine fisheries are largely unaffected by inland river water quality although the decrease in silt and organic sediment load may have localised impacts. Changes to inshore hydrology may also affect marine species like shrimp which breed and feed in Mangrove swamps in their juvenile stages (Knoop, 2012).

### 16.6.3 Employment and Livelihoods

Fishing is typically carried out by men and youths in dugout canoes on the river system or using small dhows in open sea. Netting, traps and spearing are used to catch freshwater fish and these operations usually involve only one or two individuals. Based on the annual catches in recent years it is estimated that between 250-500 individuals fish on inland waters and closer to

200 fishers engage in sea fishing close to shore. These figures are based on an average catch of 3-5kg per fisher on 250 days in the year (Odhengo *et al*, 2013).

### 16.6.4 Economic Value

Table 16.7 indicates that the larger proportion of the annual catch comes from inland fisheries (391,000 kg) compared with 221,000 kg from the sea. The overall value of fish landed in 2007 was KSh 53.14 million (Odhengo *et al*, 2014a).

## 16.7 Bee Keeping

Beekeeping for the domestic or commercial production of honey is an important economic activity carried out in the Tana Delta.

### 16.7.1 Area and Extent

Bees forage for honey wherever flowers grow in profusion and in the coastal region, most honey is recovered from trees. Much of the current beekeeping occurs around the riverine area where nectar is more abundant. The number of hives fluctuates from year to year. It is generally believed that the Delta has the potential to accommodate more hives as there is an abundance of suitable flowering species, ensuring continuity in floral resources for the bees throughout the year. Production levels are shown in Table 16.8.

### 16.7.2 Water Demand

Bees require a substantial amount of water in order to dilute stored honey and to provide cooling air through evaporation of water in order to prevent combs from melting in hot weather (Knoop, 2012). The quantities involved are nevertheless very small in relation to other land uses.

**Table 16.8: Bee Keeping for Honey Production in Tana Delta District (2006-2008)**

Types of hives	Estimated number of hives			
	2006	2007	2008	Estimated yield in 2008 (Kg)
Kenya top bar hives	300	50	350	3500-5250
Langstroth	700	400	1,100	11000-16500
Traditional hives	6,500	4,200	10,700	53,500-74900
<b>TOTALS</b>	<b>7,500</b>	<b>4,650</b>	<b>12,150</b>	<b>68,000-96,650</b>

Source: Number of Hives – (Ministry of Livestock Development, Annual Report 2008). Production Estimates (LUP/SEA)

### 16.7.3 Employment and Livelihoods

One beekeeper can manage ten colonies of bees in addition to carrying out other subsistence farming activities. To create a viable business giving full time employment requires around 50 hives, producing 500 litres/kg of honey. In practice most beekeepers will use honey production to provide cash and supplement other livelihoods. The output in 2008 would support around 140 FTEs or 1400 part time beekeepers.

### 16.7.4 Economic Value

The Langstroth (American) Hive that has largely replaced the Kenyan Top Bar Hive, is the most efficient and average honey yields per hive are in the region of 10-15 Kg. By comparison, the traditional longwall hive, provides yields of 5-7 Kg. Total value of honey produced in Tana River District in 2006-2008 was KSh 20-29 million, (based on KSh300 per litre/kg).

## 16.8 Natural Resources

Five sources of data have been used to make this analysis in addition to the community survey results undertaken as part of the LUP/SEA. These are (Mbuvi, 2004), (Matiku, 2004), (Temper, 2011), (ASFMT, 2002) and (UNEP, 2011).

The work by Mbuvi for WWF concentrates on a literature review, Rapid Trade Appraisal Survey, interviews and analysis of the 82,500 hectares of coastal forest (9% of Coastal Region). Temper's data is drawn from detailed village surveys for two communities in the Tana Delta, supported by literature research. In addition to these sources direct evidence has been provided by local community representatives especially TPAC members. A summary of the key findings is given first, under the sub-headings for area, extent, water demand, employment, livelihoods and economic value. This summary is followed by detailed descriptions for gathering edible and craft products, house construction and repair and charcoal and fuel wood collection in sub-sections 16.8.5 to 16.8.7.

### 16.8.1 Area and Extent

The land use zones from which most raw materials are harvested are forests, riverine forests, floodplain grassland and mangroves (extending to 1,186 km<sup>2</sup>), although thicket and scrub also contributes significantly to charcoal and fuel wood production (Odhengo *et al*, 2012a).

### 16.8.2 Water Demand

Almost all natural resource products are derived from vegetation and so the supply and quality of the raw material is heavily dependent on availability of water during the growing seasons. Many of the habitats have

been severely stressed by lack of water in recent dry years when droughts have become more prolonged. The volume of water required to maintain natural resource production has been assessed as a component of the 'environmental reserve' in section 2.13.

### 16.8.3 Employment and Livelihoods

There is no data on the number of people who collect natural materials in the Tana Delta, so it has been necessary to build up an estimate based on the known activities undertaken by most communities. Estimates have been calculated for gathering edible and craft products, house construction and repair and charcoal and fuel wood collection. For comparative purposes it is assumed that harvesting for four households represents the equivalent of one full time occupation. Accordingly, around 4,700-5,000 full time equivalent jobs (FTEs) are created in harvesting edible products, craft and other natural resources. A further 540-725 full time jobs are created by house building and repair, together with 5,000 jobs in charcoal manufacture and fuel wood collection. The total number of livelihoods supported by natural resources is estimated to be in the region of 10,000-12,000.

### 16.8.4 Economic Value

The annual income generated from the three main sources of natural products is summarised below:

Gathering edible and craft products	KSh 80 million
Housing construction and repair	KSh100 million
Charcoal and fuel wood	KSh 153-236 million
<b>Total</b>	<b>KSh 333- 416 million</b>

#### 16.8.4.1 Edible and Craft Products

This category of raw materials covers products that are not used in house construction or in processing charcoal and fuel wood. It relates largely to collection of fruits, nuts, edible plant material (roots and tubers), wild honey, bushmeat, insects and other products listed in **Table 16.9** which is not complete but gives an overview of the value of natural habitats. The table combines data from the sources quoted in the introduction to 16.8.

Attribution of economic values to non-timber forest products (NTFPs) is not easy since much of the harvesting activity is not monitored and produce is bartered and consumed locally. Where a price can be established, for example through sale of mushrooms or fruits in a local market, it is often difficult to assess the volume of trade. These figures can be established through direct interview in specific locations but the results cannot readily be transferred to other areas. Nevertheless it is important to include estimates for natural resource use in the Tana Delta since this represents one of the most important ecosystem services and literally sustains the livelihoods

**Table 16.9 Approximate Values for Different Natural Resource Products**

Product/ Trade Activity	Value / Item
Butterfly pupae rearing	
Butterfly exhibits	
Snake venom extraction	100/- (puff adder)
Falconry rearing	
Honey extraction	150/- per litre
Firewood extraction	20/- a bundle
Charcoal	300/- a sack
Building Poles extraction	400/- for 20 pieces
Liana cutting	N/a
Baobab (Mabuyu) ( <i>Adansonia</i> ) Fruits	200/- for 50 kg sack
<i>Landolphia kirkii</i> fruit harvesting	1-2/- per fruit
Mkwaju ( <i>Tamarindus Indica</i> ) Fruit	
Pepeta ( <i>Dialium orientale</i> ) Fruits	
Mushroom / Fungi Farming	
Neem Tree exploitation	
Dik-dik /bush meat harvesting	150/- a piece
Wild pig harvesting	400/- per animal
Large mammal poaching	Buffalo (50/- kg)
Sawn timber for construction	
Grass /reeds for thatching	100/- a bundle
Medicinal Plant gathering	
Cycad and ornamental Plant collection	
Crocodile farming	
Fish farming	
Ostrich farming	
Eco-tourism tours	50/- local ; 350/- international
Water	5/- for 20 litres

of the majority of the inhabitants. For example, within the Orma communities almost all building materials (poles/thatching reeds and grass/mud/skins) utensils (wood), food and water are derived from the immediate surroundings of the settlements.

The Management Plan for Arabuko-Sokoke Forest (2001) notes that an individual can earn KSh 16,000 a year from harvesting non timber forest products (NTFPs). Assuming that 1 in 4 households in the Delta have at least one member who collects these products would yield a NTFP and wetland resource value of Ksh 80 million.

#### 16.8.4.2 Housing

As noted above, most housing (especially in the remoter areas of the Tana Delta) is still built with natural materials and data has been obtained on construction, materials,

costs and labour in order to value these resources. Table 16.10 shows the relevant information for Pokomo houses (which are larger and more permanent than Orma designs).

**Table 16.11** gives information for Orma properties. There are an estimated 9,943 Pokomo households and a similar number of Orma households, with the total housing stock approaching 20,000 dwellings almost all of which are built by traditional methods. For the purposes of estimating total consumption and value of raw materials it is assumed that the number of new houses built each year matches the rate of household formation based on growth of population. This equates to around 300 new houses a year in both the Pokomo and Orma population (600 in total). At the same time allowance has been made for maintenance and replacement of existing housing stock.

**Table 16.10 Construction of Pokomo Houses**

House Type /Component	Construction Materials							
	Mud /Earth	Woven grass	Reeds	Palm Leaves	Palm Rope	Poles	Skins	Livestock Dung
Rectangular								
Floor construction								
Walls								
Roof								

Material type	Unit (Number /bundle / piece / etc)	Cost per item	Number of Units	Total Amount
Bricks				
Mud/Earth	Trip-lorry	7,000	3	21,000
Grass	Bundle	30	250	7,500.00
Reeds	Bundle	40	175	7,000.00
Palm leaves	Piece	5	1,500	7,500.00
Poles	Piece	40	200	8,000.00
Palm leave ropes	Bundle	100	6	600
<b>Total</b>				<b>51,600</b>

**Time and Labour**  
(Time is actual building time based on the number of labourers engaged )

House Component	Number of Labourers	Time in hours to complete	
Floor	3	2	Measuring the house
Walls	6-10 person	48	24 hrs erecting poles and 24 hrs mudding
Roof	6	36	18 Erecting the roof and 18 thatching
House finishing	2	12	General works

(Time is actual building time based on the number of labourers engaged )  
NB Assuming that they work for six hours each day .

**Table 16.11 Construction of Orma Houses**

House Type / Component	Construction Materials							
	Mud /Earth	Woven grass	Reeds	Palm Leaves	Palm Rope	Poles	Skins	Livestock Dung
Circular								
Floor construction								
Walls								
Roof								

Material type	Unit (Number /bundle / piece / etc)	Cost per item	Number of Units	Total Amount
Bricks				
Mud/Earth				
Grass	Bundle	30	100	3,000.00
Reeds	Bundle	40	70	2,800.00
Palm leaves				
Poles	Piece	400	10	4,000.00
Palm leaf ropes	Bundle	100	5	500
				10300

**Time and Labour**  
(Time is actual building time based on the number of labourers engaged )

House Component	Number of Labourers	Time in hours to complete	
Floor	1	2.5	Plastering floor after construction using sand
Walls	5	24	Four days at six hours per day
Roof	5	42	Seven days at six hours per day

The assumptions used for estimating maintenance and repairs are different for the two main housing types. Pokomo houses are rectangular with solid walls and stand for up to ten years without needing major reconstruction, although repairs to roofs are often required after heavy storms. Orma round houses are more temporary in nature, reflecting the traditional transitory nature of pastoralist settlements. It is common for Orma houses to be rebuilt after 3-4 years. Using this information it is assumed that an additional 1,000 Pokomo houses are built each year on a ten year replacement cycle, while a third (3,000 dwellings) of the Orma housing stock is replaced each year. In practice these estimates may under-estimate material needs since storm damage usually accompanies the El Nino/La Nina flood events with a 7-10 year cycle.

The information contained in **Tables 16.10** and **16.11** has been processed in order to estimate the annual quantities and costs of materials harvested for construction as shown in **Table 16.12** and **16.13**.

The costs for house construction, and reconstruction shown in **Tables 16.12** and **16.13** amounting to a total of KSh 66 million for Pokomo houses and KSh 34 million for Orma houses represents the purchase price of materials only. Detailed estimates have been secured for the time and labour required to build both types of housing, as shown in **Table 16.14**.



**Table 16.12 Materials and Value (KSh) for Pokomo New Build Housing Construction**

House Component	Units	Units/House	Total Units/Quantity All Houses	Cost KSh per unit	Cost KSh per house	Total Cost - 294 homes (new household formation)
Mud/Earth	Trip	3	882	7000	21000	6,174,000
Grass	Bundle	250	73500	30	7500	2,205,000
Reeds	Bundle	175	51450	40	7000	2,058,000
Palm Leaves	Piece	1500	441000	5	7500	2,205,000
Palm Rope	Bundle	6	1764	100	600	176,400
Poles	Piece	200	58800	40	8000	2,352,000
					51600	15,170,400

**Pokomo Annual Housing Stock Replacement**

House Component	Units	Units/House	Total Units/Quantity All Houses	Cost KSh per unit	Cost KSh per house	Total Cost - 1000 replacement homes a year
Mud/Earth	Trip	3	3000	7000	21000	21,000,000
Grass	Bundle	250	250000	30	7500	7,500,000
Reeds	Bundle	175	175000	40	7000	7,000,000
Palm Leaves	Piece	1500	1500000	5	7500	7,500,000
Palm Rope	Bundle	6	6000	100	600	600,000
Poles	Piece	200	200000	40	8000	8,000,000
					51600	51,600,000

**Table 16.13 Materials and Value (KSh) for Orma New Build Housing Construction**

House Component	Units	Units/House	Total Quantity All Houses	Cost per unit	Cost per house	Total Cost - 294 homes (new household formation)
Mud/Earth						
Grass	Bundle	100	29400	30	3000	882,000
Reeds	Bundle	70	20580	40	2800	823,200
Palm Leaves						
Palm Rope	Bundle	5	1470	100	500	147,000
Poles	Piece	400	117600	10	4000	1,176,000
					10300	3,028,200

**Repairs and Reconstruction of Orma Houses**

House Component	Units	Units/House	Total Quantity All Houses	Cost per unit	Cost per house	Total Cost -3000 replacement homes per year
Mud/Earth						
Grass	Bundle	100	300000	30	3000	9,000,000
Reeds	Bundle	70	210000	40	2800	8,400,000
Palm Leaves						
Palm Rope	Bundle	5	15000	100	500	1,500,000
Poles	Piece	400	1200000	10	4000	12,000,000
					10300	30,900,000

**Table 16.14 Labour and Time Required in House-building**

House Type	Time and Labour Requirement	No of Person/days
Pokomo	8 labourers working for a total of 13 (6 hour) days	104
Orma	5 labourers working for a total of 11 (6 hour) days	55

**Table 16.15 National Estimates for Charcoal Production in Kenya**

Population involved in Kenya	VALUE		Value per person involved	
	Ksh	USD Million	Ksh	USD
2,500,000	32,000,000,000	375	12800	150.2

Source: FAO

**Table 16.16 Estimates for Charcoal Production per Head in Kenya**

Charcoal Value (Ksh)	Price (50 Kg Bag)	No of 50 Kg bags	Tonnes/Annum	Bags/person	Value per person (Ksh)
32,000,000,000	200	160,000,000	3,200,000	64	12800

Around 150,000 person days of work is involved in building for the Pokomo community and a further 181,000 days for the Orma community (Odhengo *et al*, 2013). Person/days of effort are divided by 250 in order to arrive at annual job equivalents. Based on this data it can be estimated that around 540 and 725 full time jobs are created in house building and construction in the two communities, although in practice household members undertake much of the work.

**Charcoal:** Three methods have been used to assess the amount and value of charcoal production in the Tana Delta. These rely on establishing a national average (Method 1); calculating production and value based on Tana River District Reports (Method 2) and review of data provided in research by Leah Temper (2011) (Method 3).

Charcoal is produced throughout the Delta – much of it for local consumption as a principal energy source, but the main concentration of marketing activity takes place on the western terrace (where bags are sold to passing traffic on the Malindi-Garsen road) or through the town centres of Garsen, Witu, Tarasaa and Kipini.

*Method 1- National Average:* FAO publishes estimates for national levels of charcoal production. Kenya is estimated to produce charcoal a year to the value of Ksh 32 billion with the involvement of 2.5 million people. This equates with an average value per person of Ksh12,800 per year (see **Table 16.15**).

If it is assumed that the average retail price per 50 Kg bag is Ksh200 this equates to an annual production of

160million bags or 3.2million tonnes. The equivalent production rate is 64 bags/annum/person and this agrees precisely with the figure generated for annual income per person (see **Table 16.16**).

*Method 2 - Tana District data:* No information exists on the levels of production within the Delta itself but risk assessment reports produced at monthly intervals by the former Office of the Prime Minister<sup>3</sup>, give an indication of its importance. These reports show that 20% of household income (based on a sample of 450) is derived from sale of charcoal. However the sampling process applies to the whole of the former Tana River District, which extends over a wide area of rangeland outside the Delta so this figure would be unrepresentative of the Delta population.

The Orma and Wardei population (representing slightly less than 50% of the whole for the Delta) is only engaged in a marginal way with charcoal production. Surveys suggest that roughly half the Pokomo (and other ethnic groups engaged in sedentary land uses) carry out charcoal production and marketing. On this basis it is assumed that 25% of households in the Delta (i.e. 19885/4 = 4971 households) take part to some extent with charcoal production and marketing. A further assumption has been made that these households will have a higher income than the majority. Seventy per cent of the population are classified as living in poverty (earning less than 1 USD a day in disposable income) and it has therefore been assumed that those involved in charcoal will have an income above this level which is arbitrarily set at 170 Ksh per day (2 USD per day) for the purposes of estimation. The data produced on income sources

<sup>3</sup>Poverty Relief

indicates that charcoal accounts for 19% of household income in Tana District. If these figures are applied to 25% of households in the Delta the results indicate an estimated annual income of 11,820 Ksh specifically from charcoal for each household. The combined income for all 4,971 households would amount to around Ksh 58.8 million or 690,000 USD.

**Method 3: Delta data:** This assessment is based on data produced by Temper (2011). A survey of biomass consumption in the Pokomo settlement of Vumbwe in 2010 indicated that charcoal constituted 75% of wood extraction, with about half of the 27 households (i.e. 13) producing charcoal for sale. An average of 40-60 (50kg) bags were produced a week representing 3-4.6 bags per household (equating to 20 tonnes of timber felled). Temper notes that 'Charcoal is harvested in the Delta primarily along the floodplain where the tree growth is lushest'.

A single respondent in the survey gave detailed information on charcoal production stating that he could produce up to 20 bags of charcoal per week if there was a firm order, or an average of at least 5 bags a week without orders. Each bag was assumed by Temper to have a value of Ksh175 (midway between wholesale and market price). Based on this information Temper quotes the potential for this individual to earn a gross income of Ksh87,000 per annum based on 250 hours of production

(at 30 minutes per bag). This figure is considered in this report to represent an absolute maximum rate of production. If the average rate of charcoal production per household in Vumbwe (i.e. 3-4.6 bags a week) is used as the basis for calculation this equates to a weekly income of Ksh525-805 (6.2-9.5USD) per household or Ksh 27,300-41,860 per annum.

**Summary:** The three methods produce a significant variation in values so the results have also been compared with other data for East Africa (Malimbwi & Zahabu, 2007). **Table 16.17** shows the comparison of estimated income levels from the Tana Delta with locations in Tanzania and Mozambique.

Having explored the range in values, it is concluded that the estimate based on method 3 gives the most likely approximation to conditions in the Tana Delta and the remaining calculations are based on the assumption that 25% of all households (4,791) in the Delta engage in charcoal production, producing between 3-4.6 bags a week per household (See **Table 16.18**). This suggests that total production of charcoal in the Delta amounts to between 37,000 and 57,000 tonnes per annum. Allowing for an average conversion rate of 10 tonnes of timber for 1 tonne of charcoal, the equivalent annual consumption of wood for charcoal alone would amount to between 370,000 and 570,000 tonnes.

**Table 16.17 Productions and Value of Charcoal per Household in East and SE Africa**

Location	Bags / HH/Year	Annual Income from charcoal (USD)	Sources
Tanzania Morogoro Highway		176	Monela <i>et al</i> (1993)
Tanzania	278	445	Monela <i>et al</i> (2000)
Tanzania	516	645	Chaposa (2002)
Licuali region Mozambique		450	Chaposa (2002)
Kenya National statistics	64	150	LUP/SEA (Method 1)
Kenya - Tana District		138	LUP/SEA (Method 2)
Kenya - Tana Delta	156	322	LUP/SEA (Method 3)
Kenya - Tana Delta	239	494	LUP/SEA (Method 3)

**Table 16.18 Estimates for Charcoal Production in the Tana Delta**

Number of Households	Value (Ksh ) 3 bags / HH	Value (Ksh) 4.6 bags / HH
Value per household/year	27300	41860
Total Value 4791 HH/year	130,794,300	200,551,260
Number of bags all HH/year	747,396.00	1,146,007.20
Number of tonnes all HH/year	37369.8	57300.36
Timber equivalent (tonnes)	373698	573003.6

In order to consider the area of forest required to supply this volume of fuelwood it is necessary to convert tonnes to cubic metres. Forestsnetwork.org employs a ratio 1.7m<sup>3</sup> to one tonne for fuel wood. Hence the equivalent volume of timber required to provide 373,698 tonnes of wood fuel is 635,286 m<sup>3</sup> while the amount needed to provide 573,004 tonnes is 974,196 m<sup>3</sup>.

At a mean harvestable rate of 14 m<sup>3</sup> per annum from 1 hectare of land (Malawi figures) a total of 45,000 hectares of woodland is required to sustain production of 3 bags of charcoal per household per week in the Delta. This figure rises to 69,500 hectares if the production rate is assumed to be 4.6 bags per week.

**Firewood:** Charcoal accounts for an estimated 75% of all fuel wood harvested, while firewood takes the balance of 25%, which amounts to between 211,762m<sup>3</sup> and 324,702m<sup>3</sup>. Based on a sustainable yield of 14m<sup>3</sup> per hectare of open woodland this requires an area

of 15,125-23,193 hectares. The combined area of woodland and scrub required to support both charcoal and firewood harvesting at the estimated current rates is 60,125-92,690 ha. These figures can be compared with the estimates of forest and scrub cover in the delta comprising:

Scrub and thicket	40,000 ha
Riverine Forest	32,300 ha
Woodland	27,100 ha

Most of the Riverine Forest has reserve status and should not be exploited for timber or firewood and the same applies to some core woodlands, like Ozi forest. In consequence it is unlikely that available scrub, thicket and woodland (99,400 ha) is sufficient to support sustainable production of charcoal and firewood at the present time. The information gathered in the preceding section has been summarised in **Table 16.19**.

*The most recent FAO report that provides an update on woodfuel statistics is the Global Forest Resources Assessment 2005 (FRA 2005). This estimates the total harvest of 'industrial roundwood' (industrial timber) from forests in sub-Saharan Africa in 2005 at 42 million tonnes (70 million cubic metres). This was far outstripped by fuelwood removals for the region, which are reported as 251 million tonnes (418 million cubic metres), suggesting that over 80 per cent of the wood harvested from Africa's forests is for woodfuels.*

**Forestsnetwork.org**

#### **Extracts from Malimbwi R.E. and Zahabu E., 2007**

*The stand density of woody Plants in dry forests varies widely. For instance, in miombo woodland the stand density of woody species mostly ranges between 380 and 1,400 stems. In most miombo stands, the basal areas range from 7 to 25 m<sup>2</sup> per ha. In Eastern Tanzania, the volume of harvestable trees for charcoal in miombo woodland is 35 m<sup>3</sup> ha<sup>-1</sup>. The mean annual volume increment (MAI) in mature miombo woodland ranges from 0.58 to 3 m<sup>3</sup>ha<sup>-1</sup>yr<sup>-1</sup>.*

*The mean harvestable volumes in miombo range between 14 m<sup>3</sup> per ha in dry miombo of Malawi (Lowore et al., 1994) and 117 m<sup>3</sup> per ha in Zambian wet miombo (Chidumayo, 1988). In Eastern Tanzania, the volume of harvestable trees for charcoal in miombo woodland is 35m<sup>3</sup>ha<sup>-1</sup> (Malimbwi et al, 2005). Average aboveground biomass in old growth miombo woodland varies mostly from around 30 tons per ha to about 140 tons per ha (Malaisse, 1978; Malimbwi et al., 1994) generally depending on the amount of annual rainfall and edaphic properties.*

*In 2002, about 17.84 million m<sup>3</sup> of wood were used for charcoal production in Tanzania. It is estimated that clearing of one hectare of Miombo woodland provides on average 35m<sup>3</sup> of firewood for charcoal production.*

**Source: The analysis of sustainable charcoal production systems in Sub-Saharan Africa (FAO) -**[www.fao.org/docrep/012/i1321e/i1321e10.pdf](http://www.fao.org/docrep/012/i1321e/i1321e10.pdf)

**Table 16.19: Charcoal and Firewood Production in 2010**

Category/Year	2010
<b>Population</b>	102,000
All Households (5.2 occupants)	19,885
25% of Households engaged	4,971
<b>Charcoal</b>	
Thousand Tonnes	37-57
Woodland (000 Hectares)	45-69
Value (KSh Million)	130-200
<b>Firewood (25%)</b>	
Thousand Tonnes	9.2-14.2
Woodland (000 Hectares)	11-17
Value (KSh Million)	23-36
<b>Charcoal &amp; Firewood Combined</b>	
Thousand Tonnes	46.2-71.2
Woodland (000 Hectares)	55-85
Value (KSh Million)	153-236

## 16.9 Tourism

### 16.9.1 Area and Extent

Tana Delta hosts a wide diversity of wildlife that could form a major tourist attraction. Species include lions, elephants, buffaloes, hippos, crocodiles, giraffes, leopards, ostriches, warthogs, baboons, antelopes including the coastal race of topi, monkeys including rare and threatened species, and various species of large and colourful birds, among others. Other tourist attractions are the 76km of coastline (pristine white beaches). There is one private wildlife sanctuary, Nairobi ranch (now Kipini Conservancy), located near Kipini and some community managed conservancies.

### 16.9.2 Water Demand

Tourism can generate high levels of demand for water per capita, but at the present level of activity in the Delta, water use is insignificant.

### 16.9.3 Employment and Livelihoods

Tourism is a capital and labour intensive industry, with the typical ratio of staff to visitors ranging from 1:3 to 1:15 for organised tours (Safaris). Quality hotels employ one staff member for every guest room, while guesthouses may have less than one staff member for five guests (Odhengo *et al*, 2013). For the hotel category within Tana Delta employment is based on one staff member per room amounting to 50 (assuming double occupancy /room). Employment in guesthouses is estimated at the ratio of 1:5 equating to 40. Other personnel are employed as guides, drivers, gardeners etc and double the internal staff complement (Odhengo, *et al* 2013). The combined total of employees is therefore estimated to be in the region of 200 FTEs.

### 16.9.4 Economic Value

Tourism is underperforming (2013), despite its huge potential, largely because of recent conflict in the region.

**Table 16.20 Notional Levels of Visitor Activity in the Tana Delta, 2013**

Type of Accommodation	Bedspaces	Occupancy Rate	Number	Rate US\$	Amount
Hotel / Luxury Camp	100	5% / International visitors	1825	60	109500
Hotel / Luxury Camp	100	15% / National Visitors	5475	5	27375
Local Guest houses	200	50% Local Visitors	36500	2	73000
<b>Total</b>					<b>209875</b>



There are currently three established hotels and camps within the Tana Delta with a combined bed space of under 100, and a number of houses providing rooms for local travellers. Assuming occupancy levels of 5% for international visitors, 15% for national visitors and 50% for local users, and a daily income of 60\$ per international visitor, 5\$/day for national residents and 2\$/day for local users, the total turnover from tourism might be in the region of KSh 17.6 million (USD 210,000).

## 16.10 Trade

### 16.10.1 Wholesale, Retail, Commerce and Finance

#### 16.10.1.1 Area and Extent

Trading activities in the Tana Delta Plan Area are fairly low since among other challenges, access to credit is limited. Currently access to credit is provided by financial institutions that include Kenya Women Finance Trust, Kenya Commercial Bank and Barclays Bank of Kenya. The main commercial activities are concentrated in Garsen with lower order services in other centres such as Kipini, Ngao and Tarasaa.

Formal commercial activities in the Plan area mainly consist of small scale, wholesale and retail shops (see **Table 16.21**). These are mainly concentrated in Garsen town – the main urban centre.

#### 16.10.1.2 Water Demand

No separate assessment of water requirements has been made under this activity since the production elements which consume water are covered under ‘manufacturing’ and other uses fall under domestic consumption.

#### 16.10.1.3 Employment and Livelihoods

**Table 16.21** indicates that there were around 489 businesses in 2008. If it is assumed that each employed

an average of three workers this would give around 1500 FTEs. However, trading is not restricted to formal businesses and bartering forms part of every household’s economic activities. Petty trade is shown as accounting for 11% of the average household income in Tana River District in 2011 (Government of Kenya, 2012) (See **Figure 16.1**). On the basis that trade represents one tenth of each household’s income this equates to 1,988 full time jobs within the Plan Area. The combined estimate for livelihoods based on Trade, commerce and financial services is therefore 3,488 FTEs.

#### 16.10.1.4 Economic Value

Data on income sources within Tana River District Development Plan (2008-2012) is quoted only in percentages with no absolute values. However, the information generated earlier on charcoal provides a possible basis for estimating overall figures.

The estimated value for 25% of households engaged in charcoal production in the Delta is KSh 27,300-41860/HH/year. In order to arrive at an average for the entire population these figures need to be divided by 4 giving KSh 6,825-10,465 per household.

If these figures are substituted into a table, based on the percentages given in **Figure 16.1**, the results are as shown in **Table 16.22**.

The gross individual household annual income range of KSh 34,125-52,325 per annum is equivalent to KSh 93.5-143.4/day or 1.1-1.7 USD/day, which probably equates fairly well with the very low-income levels for the majority of the population.

**Table 16.22** provides an indicative breakdown of individual income from which it can be seen that petty trading accounts for 11% of income. If this percentage is applied to the two estimates of annual income, the related annual sum for individual trading income ranges between KSh 3,754 and KSh 5,756. Taking the trading component from **Table 16.22** the gross trading level for the Tana Delta, based on 19,885 households, would be KSh 74million – KSh 114 million.

The gross household income for the Tana Delta population would amount to KSh 678 million – KSh 1.04 billion with the average being KSh 859 million.

Seventy per cent of the population lives below internationally defined poverty levels in terms of cash income (although wealth for some ‘poor’ families as expressed by livestock ownership may be quite considerable). Lack of disposable income greatly reduces purchasing power amongst the general population.

**Table 16.21: Type and Number of Businesses**

Type of business	Number
Wholesale	6
Catering	
Retail traders	112
Garages	1
Jua kali artisans	50
Small scale traders	317
Distribution	
Financial institutions	3

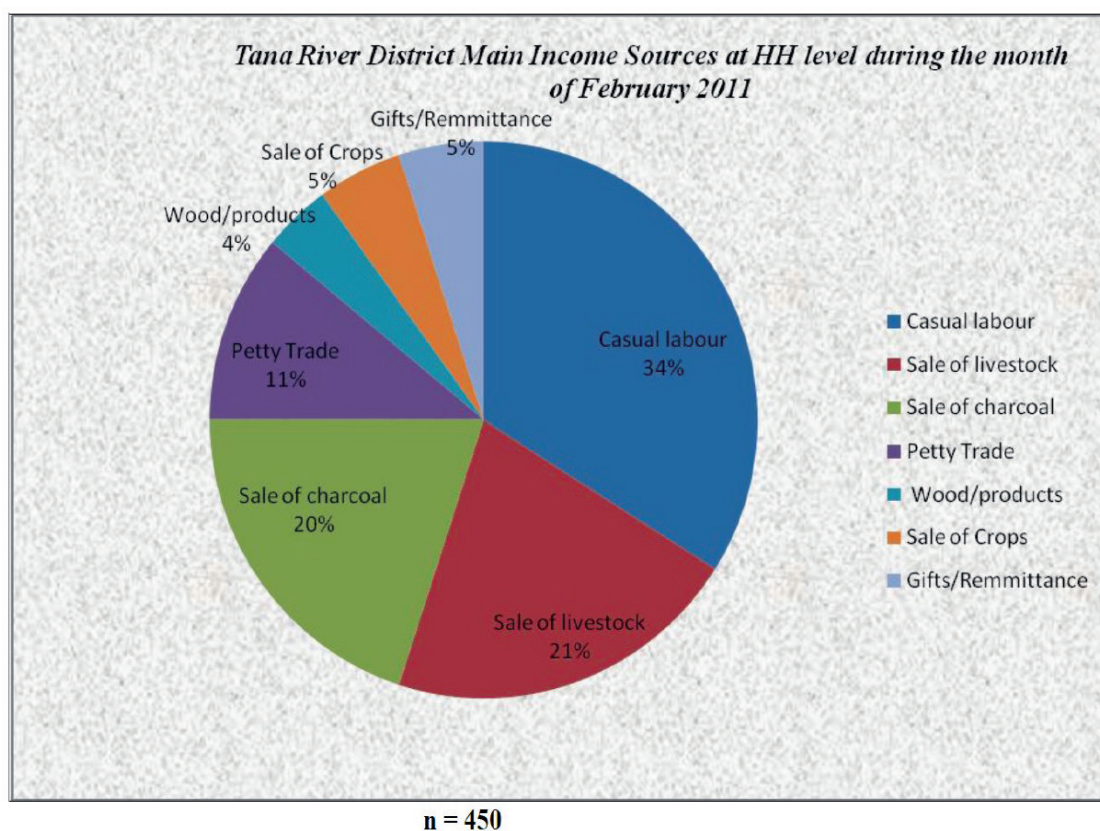
Source: Tana River District Development Plan, 2008-2012

**Table 16.22 Estimated Values for Average Income in Tana Delta**

Element	Percentage	Values	
Charcoal sales	20	6,825	10,465
Livestock sales	21	7,166.25	10,988.25
Casual Labour	34	1,1602.5	17,790.5
Wood products	4	1,365	2,093
Petty Trade	11	3,753.75	5,755.75
Sale of crops	5	1,706.25	2,616.25
Gifts /Remittances	5	1,706.25	2,616.25
<b>Totals</b>		<b>34,125</b>	<b>52,325</b>

Source: Tana River District Development Plan, 2008-2012

**Figure 16.1 Percentage Contributions to Household Income in the Tana River District, 2011**



Source: Tana River District Development Plan, 2008-2012

However, in terms of trading and commerce the amount of money changing hands through middle men in livestock, food produce and retail sales can be substantial. The Wema and Hewani Village Business Plans indicate that rice sold at the 'farm gate' in the Delta in 2012 averaged Ksh 3,250 per 90 kg bag while the wholesale price in Malindi and Mombasa was Ksh 5,200 -5,800 (Odhengo *et al*, 2012c). The difference of 1950-2550 Ksh represents a mark-up of 60-78%, of which only a part is due to transport costs.

## 16.11 Mining and Industry

### 16.11.1 Area and Extent

Mining activities in the Plan Area are minimal at the present time. There is harvesting of sand and sea salt especially in the Southern part of the County. There is also the potential for titanium prospecting in the Delta.

No direct information is available on salt mining within the Delta area but a report on coastal salt mining in Kenya estimated that the annual output from 5,000 hectares is 170,000 tonnes, averaging 34 tonnes per hectare (UNEP, 1998). Assuming that the salt works lying within the extreme south western corner of the Delta cover 500 hectares the equivalent salt production is 17,000 tonnes/annum.

Industrial activities are also minimal in the Delta. A nominal area of 10 Ha is included in the summary table 16.26. The main rice mill has recently been rehabilitated and is managed by TARDA but is only operating at about 30% of its capacity due to low rice production. Most commercial activities are of cottage industry scale or are informal in nature and include furniture making, mat making, home based oil extraction and butter making. These activities form part of the subsistence economy.

### 16.11.2 Water Demand

The current level of industrial and mining activity in the Tana Delta does not generate a significant water demand.

### 16.11.3 Employment and Livelihoods

With the exception of salt processing, for which an estimated 50 FTEs are involved, the contribution of this sector to employment and incomes is minimal but has high potential. Exploration has recently commenced for oil and gas within the Lamu section of the Tana Delta. Communities living in the Delta are engaged in various economic activities ranging from crop farming, livestock keeping, fishing, informal trade and seasonal and formal employment (See Table 16.23).

**Table 16.23: The Economic Activities of Tana River Delta Communities**

Occupation	Percentage (%)
Herdsman (pastoralists)	38.9
Keeping livestock	8.3
Business man/woman	1.7
Farming and livestock	8.9
Farming	35.6
Employed	6.7
<b>Total</b>	<b>100.0</b>

Source: HVA International, 2007

### 16.11.4 Economic Value

The world price ex-mine for sea salt in 2010 was USD 180/tonne according to the US Geological survey. Consequently, the value of estimated production from the Tana Delta area would amount to USD 3.06 million (KSh 257 million).

## 16.12 Infrastructure

The Tana Delta has the benefit of a major road passing round its perimeter and linking Malindi (and the rest of the southern coastal towns) to Garsen, and Lamu. However, until the advent of the LAPSET corridor and Lamu Port project, this route had been seriously neglected and even today some parts of the road are severely pot-holed – especially the extension north to Hola and Garissa.

The remainder of the road network in the Delta consists of short lengths of tarred road to Tarasaa and Kipini but the majority of roads and tracks are gravel-bound or beaten earth. Electricity supplies to the principal settlements have been significantly upgraded with the construction of a new national grid powerline linking Mombasa and Lamu. Much of the rural area is without electricity.

There is no easy way of valuing the current expenditure on infrastructure in the Tana Delta, but an approximation has been made by applying the percentage figure of 12.1%, which relates to Gross National Product as recorded in the National Accounts (2012), to the other economic data collected for the Delta. This figure amounts to KSh 1,202 million in 2050.

## 16.13 Administration, Professional Services, Education and Health

### 16.13.1 Public Administration

The public sector includes staff working for the County Governments (formerly employed in district positions by the national government). As in the case of professional

services, this sector currently makes up only a small component of economic activity, although under the newly devolved functions of County Governments its importance will grow rapidly once the embargo on new appointments is lifted and funds become available.

### 16.13.2 Professional Services

A very small number of people are employed within the Tana Delta in professional fields such as banking, surveying, veterinary services, teachers and doctors.

These sectors may be expected to grow in direct relationship to the expansion in population and size of the local economy so the figure of 11.1% (the percentage of GDP, as recorded in the National Accounts, 2012) has been applied to the data collected for all other sectors of the local economy. This yields a figure of KSh 1,706 million in 2050.

### 16.13.3 Urban Areas

The physical extent of urban areas including both the main towns and rural villages has been estimated at 2,620 hectares. This includes large areas of vacant land within the nominal settlement boundaries, which seldom have any formal limits.

## 16.14 Water Resources

Water resources are included, like natural resources of which they are a part, because most economic activities in the Tana Delta depend to some extent or other on the River Tana for its water resources. In the dry seasons, villages which are remote from the river rely on excavating small pits in dried up channels and depressions. But even this water source is dependent on recharge from the main river and from surface floods during the rains.

### 16.14.1 Water Consumption

Water is required for crop irrigation, livestock and domestic consumption and nature conservation. Natural conditions of water supply have deteriorated in the last forty years as a result of impoundments in the Upper Tana Catchment. Research for the SEA has shown that flows in River Tana have historically maintained a minimum monthly mean of 60m<sup>3</sup>/second at Garsen (Idsowe Bridge), with levels dropping to 45 or 30m<sup>3</sup>/second in only a few months in extreme drought years. Much of this water is distributed through minor channels across the lower floodplain where it sustains wetlands on which local communities depend for their livelihoods as well as sustaining the rich biodiversity.

**Domestic Consumption:** Existing levels of water consumption remain very low in terms of permanent abstraction since waste water is returned naturally to

the system. Human consumption of water is restricted by the capacity of women and children to collect it. If it is assumed that the average abstraction per person for all purposes is 20 litres (Isola Figures) (Mati, 2006) this equates to a daily demand of 2.04 million litres (2040 m<sup>3</sup>/day). This compares with average consumption per head of 150 litres/day in Nairobi (IEA, 2007).

**Agriculture:** Most farming in the Tana Delta relies on rainfall during the wet seasons, receding floodwaters and natural groundwater percolation. Consequently it is hard to attribute a precise value to water uptake. It is reasonable to assume, however that in a typical 90 day period for crop production, plants will absorb soil water at a rate of 100 mm per month equating to 0.33m<sup>3</sup> per square metre.

**Livestock:** The daily water intake for cattle in rangelands is in the region of 12-20 litres, although this is for beef cattle and dairy cows require 50-100 litres when lactating (IRIN, 2007). Daily consumption will be in the region of 4,240M<sup>3</sup>/Day (assuming 15% are milking cows). This estimate deals only with direct water consumption. The amount of water taken up by grass and plants and eaten as forage by livestock and wild herbivores is likely to be on a comparable level to agricultural cropping.

**Water and the Environment:** Water is the source of all life within the Tana Delta and a substantial amount of the water reaching the Delta is absorbed by soils and vegetation or is lost through evaporation. Considering only the area of the Lower Delta, which contains the most important areas of wet grassland, plant growth and evapo-transpiration require a minimum of 100 mm per month in excess of rainfall during the six driest months of the year (Government of Kenya, 2009). The water uptake by vegetation and evaporation in this area of 70,000 hectares approaches 5.1 million m<sup>3</sup>/day, (or 59m<sup>3</sup>/sec) representing most if not all of the River Tana flow through the Delta. This figure therefore represents the minimum flow that is required to safeguard the Delta's rich biodiversity, land uses and cultural heritage and should be adopted as the 'environmental reserve' – meaning the minimum amount of water that should flow to the Delta, regardless of the demands and uses for water upstream.

### 16.14.2 Water Sources

The main supply to the Tana Delta is provided by the River Tana, augmented by occasional flash floods and discharges from the lags. Ground water is exploited by the local population, especially in areas that are remote from the permanent river channels, but all ground water is ultimately recharged from the river and annual flooding.



The River Tana divides below Idsowe into two channels – the ‘Main’ river which now takes only about 40% of the flow and the newly established eastern channel, the Matomba Brook, which takes around 60% of the flow. The volume of water in the Main river in dry months is too small to sustain the level of farming activity previously undertaken (due to salt water incursion at high tides). Water supply to the central wetlands is adequate except in drought conditions.

The management of water resources within the Delta is very difficult for two reasons. Firstly, the flow in the River Tana is dictated by seasonal variations and levels of abstraction upstream. Secondly, the physical direction of flows to different parts of the Delta is dependent on the prevailing structure of the river channels and any attempts to engineer alternative routes using canals are liable to be destroyed by floods. Catchment areas or riverine areas are not protected, right from the Upper Delta region around Mbalambala, Boka, Malkamasa. In these regions indigenous trees have been cut and this affects the flow downstream since the water flows downstream at the Delta with a stronger force and changing its course more frequently

In simple terms the existing water balance in the Tana Delta has already dropped below its natural state with the construction of upstream dams and water abstraction points. **Continued maintenance of the Primate National Reserve and the Tana Delta Ramsar sites, biodiversity, livelihoods and culture is dependent on maintaining an average monthly flow in the River Tana at Garsen of 60m<sup>3</sup>/second for the reasons described in section 16.13.1 .**

**Water Sales:** The LUP Baseline Report refers to the fact that there are 404 water vendors within the Plan Area. It is assumed that they are distributing packaged water. Although the number of vendors is very small, their existence is significant because many parts of the Delta are too remote to be provided with piped supplies.

## 16.15 Biodiversity

### 16.15.1 Area and Extent

The natural resources of the Tana Delta include its soils, vegetation and wildlife on which many economic activities are based. A rich mosaic of habitats makes up the Delta including riverine forest, dry woodland, palm savannah, lakes, swamps, river channels, mangrove, dunes and grassland. All of these habitats depend on the continuing flow of the River Tana. In recent decades the number of some larger mammals (Buffalo, Giraffe, Waterbuck and Zebra) has declined due to increasing competition over grazing land with livestock, the spread of human settlement which has intruded on traditional

migratory routes (from Tsavo East National Park and the North Eastern rangelands to the Delta) and in the case of aquatic species like Hippopotamus from the loss of habitat (See **Table 16.24**). Other species have actually increased in numbers between 1993-2003 but no more recent data is available.

The most iconic of the Delta’s wildlife – the Tana River Red Colobus and Tana River Crested Mangabey – live in dense riverine forest and are hard to count. Although the population appears to be stable the habitat is under constant threat from tree clearance.

Birds constitute a very important part of the Tana Delta ecosystem and apart from justifying its status as an Important Bird Area (IBA) they are also a significant dimension in the area’s designation as a Ramsar site. More than 22 species of wetland birds gather in the Delta in numbers which are of international significance and there are a number of large colonies of water birds like egret, heron and ibis.

**Table 16.24: Wildlife Population in the Delta**

Species	1993	1996	2002
Buffalo	8,644	1,884	1,518
Eland	736	78	-
Elephant	122	255	239
Grant Gazelle	2,325	3,846	3,537
Gerenuk	2,345	3,022	4,356
Giraffe	3,799	1,315	1,218
Hunter’s Hartebeest	407	19	-
Lesser Kudu	1,259	883	2,098
Oryx	1,802	2,178	1,019
Ostrich	1,414	1,044	419
Topi	5,679	255	-
Warthog	1,666	2,590	2,677
Waterbuck	1,201	608	139
Plains Zebra	2,461	2,355	1,538
Grevy’s Zebra	38	37	-

Source: Kenya Wildlife Service

Valuing biodiversity presents many challenges. There are a number of environmental economic measures that are used including contingent valuation, willingness to buy and hedonic pricing. These techniques were used for the Arabuko-Sokoke Forest Management Plan (2001). An equivalent exercise has not been undertaken for the Tana Delta because it contains very variable habitats and, to date, the value of its biodiversity for tourism has hardly been tapped.

The status and condition of the natural environment in the Tana Delta is heavily dependent upon the protection and enhancement of the many varied habitats which give rise to its biological diversity. In one sense the special qualities of the Delta stem from the richness of all the



habitats. Consequently the loss or deterioration of any component will inevitably weaken the whole.

However, some areas may be regarded as of exceptional importance because together they sustain the most important fauna and flora of the Delta. These areas, regarded as primary habitats, are shown in **Table 16.25**.

**Table 16.25 Primary Habitats Making up the Core of the Tana Delta**

Habitat Type	Area in Km <sup>2</sup>
Forest	271
Riverine Forest	323
Water	18
Floodplain grassland	508
Mangrove	84
Dunes	103
Migratory Corridors through thicket	100
<b>Total</b>	<b>1,407</b>

The term “primary habitat” is used to distinguish between the core areas and other ‘secondary’ habitats that are important for individual species but are not the primary reason for the area’s designation as a Ramsar site. In addition to the specific habitats listed in **Table 16.25**, another critical component of the Delta’s biodiversity is the existence of migratory land corridors through the buffer zone which are used by both wild animals and livestock in order to pass between the core of the Delta and the wider rangelands. It has been assumed in this assessment that each of the existing five corridors should be maintained with a minimum width of two kilometres and a length of 10 kilometres through those parts of the thicket and scrub zone lying within the Plan Area.

Having identified the primary habitats, and provided an estimate of their total extent in 2010 as 1,407 Km<sup>2</sup>, this figure may be regarded as the benchmark against which future change in the extent of habitats may be measured. Clearly any loss in area will have an absolute and finite impact on the habitat in question. Erosion of the edges to habitats will also have effects on the remaining core areas and may reduce the size of the sensitive area below the ‘critical mass’ at which certain

species of plant and animal that are vulnerable to human disturbance can survive. Finally, a range of human activities that may be tolerated when practiced on a small scale or individually – like gathering reeds, grasses and wooden poles or harvesting fruits and mushrooms – may end up degrading the resource so heavily that natural regeneration becomes impossible. There is insufficient data to allow these effects to be modelled in a meaningful way so under each scenario the likely changes are described verbally.

### 16.15.2 Wildlife Corridors

Tana Delta provides vital ecosystem services to a much wider area than the Delta itself, due to its retention of water and wetlands in the dry seasons and the availability of grazing for both wild and domesticated animals.

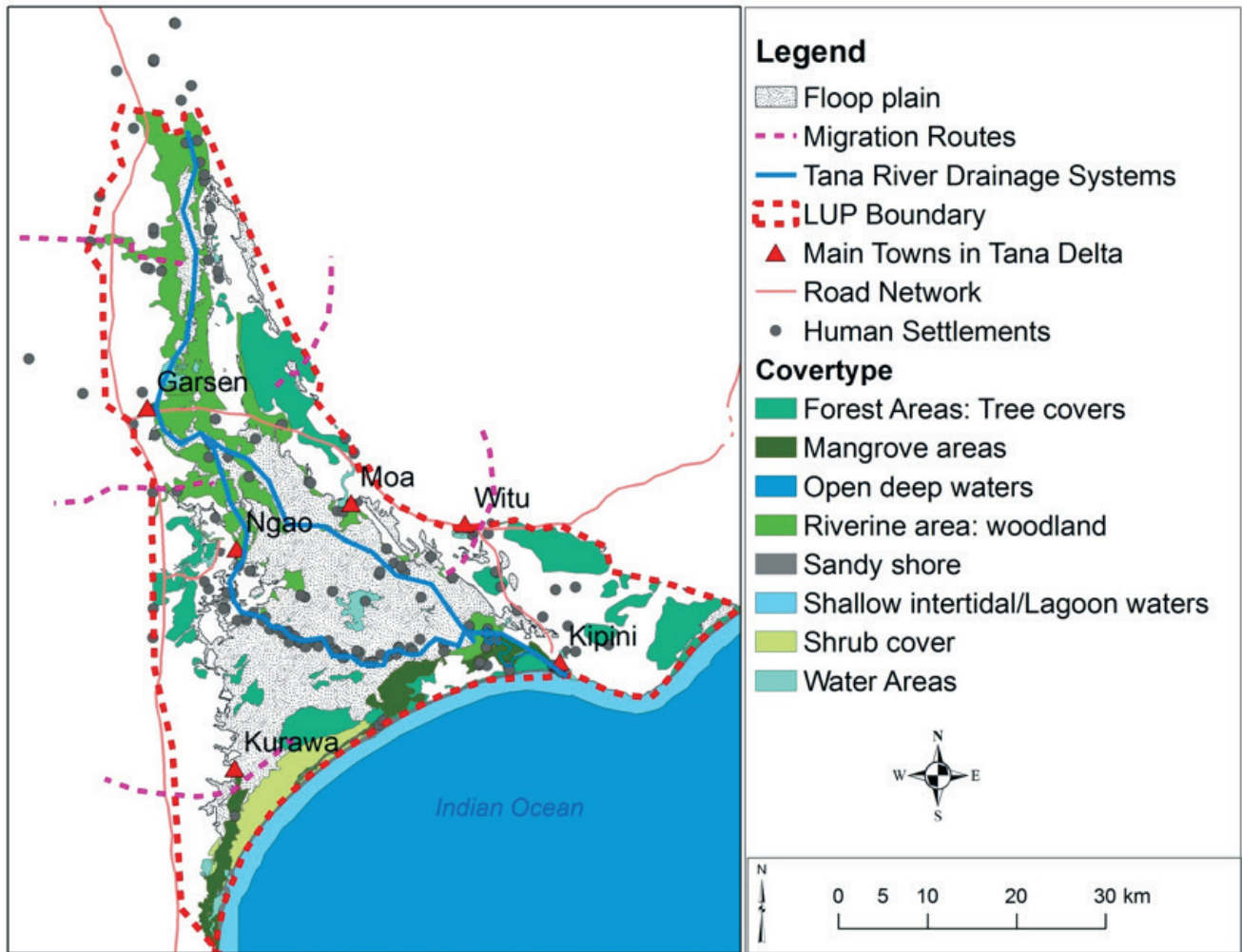
Large herbivores have used fixed migratory routes between areas like Tsavo East National Park and other areas of North East Kenya for centuries. The migrations take place twice a year and although they are on a much smaller scale than the internationally famous Serengeti/Masai-Mara migration, they are nevertheless of great importance in preserving elephant and antelope populations across the entire region (Bennun and Njoroge, 1999). Five routes exist into the Delta: two from the north east and three from the north west and west and their positions are shown in Figure 16.2. The same routes are used by pastoralists when herding cattle between the Delta and wet season grazing areas. Illegal wildlife poaching has been frequent along the wildlife migratory corridors over the years resulting to diminishing wildlife populations.

In addition to the established migratory routes, land lying between separated blocks of riverine forest and other habitats within the Delta serves a similar function in allowing mobile species, like primates and birds, to travel to and from different territories. Conversion of these areas from thicket, scrub or grassland to permanent agriculture increases the isolation of remote habitats and increases the pressure on the survival of rare species.

## 16.16 Summary

The characteristics of baseline conditions in the Delta are summarised in the following **Table 16.26**.

**Figure 16.2 Principal Migratory Routes**



**TABLE 16.26 Baseline Summaries**

Component	Measure/Unit	2010
Population	Thousands	102
Workforce	Thousands (51% of population - LUP Baseline Report)	52
Urban Area	Km <sup>2</sup>	26.2
Industrial land	Hectares	10
Open Grazing	Area occupied (Km <sup>2</sup> )	1128
	Cattle- Maximum number	735,000
	Cattle - Minimum number	220,000
	Cattle - Average number	477,500
	Average value (KSh @ 12,000/head)	5.73 Billion
Ranches	Area occupied (ha)	9,200
	Cattle - Maximum number	480
	Cattle- Minimum number	480
	Cattle- Average number	480
	Average value (KSh million)	3.1
Farming	Potential Arable Area (Km <sup>2</sup> )	1100
	Permanent Cultivation (Area Km <sup>2</sup> )	6.2
	Subsistence Farming (Number of people supported)	102,000
	Value of crop production (KSh million)	828
	Irrigated land (ha)	385
	Labourers ('000s)	12
	Commercial farms (Has)	450
Fishing	Number of Kgs/annum	613,003
	Value (KSh million)	53.14
Bee keeping	Number of hives	12,150
	Honey (000 Kg)	68-96
	Value (KSh million)	20-29
Natural Products	Area required for harvesting (Km <sup>2</sup> )	55-85
	People engaged in NTFP harvesting	4971
	Income generated (million)	80
	House building using natural materials (KSh million)	100
	Employment in house construction (number of jobs)	1,165
	Charcoal / Firewood (000 tonnes)	153-236
Tourism	Turnover (Value 000 USD)	26
Trade	Household trading activities (KSh million)	859
Industry & Mining	Area Involved (Salt ponds Kms)	0.5
	Turnover (Value KSh million)	257
Infrastructure	Services / Transport (KSh million)	1,202
Administration/ Professional Services/ Education / Health	Gross turnover (KSh million)	1,706
Water Demand	Domestic (m <sup>3</sup> /day)	2,040
	Commercial / Industrial (m <sup>3</sup> /day)	0
	Livestock (m <sup>3</sup> /day)	4,748
	Farming (m <sup>3</sup> /day)	10,548
	Environmental Reserve (m <sup>3</sup> /day)	5.2 million
Biodiversity	1,407 Km <sup>2</sup> Prime habitats = 100	100

# CHAPTER 17

## SCENARIO A - CONTINUED DEVELOPMENT OF TRADITIONAL LIVELIHOODS

### 17.1 Definition

This scenario is based on projections for continuing population growth in the Tana Delta and the assumption that local communities will continue to provide for their own needs by maintaining traditional forms of livelihood. Specific elements of the scenario are that:

- i. The number of people resident in the Delta will increase from the present 102,000 to 156,000 by 2030 and to 281,000 by 2050;
- ii. Water availability in the Delta will decrease as water is diverted from the River Tana to serve other communities and development projects in the Upper and Middle Catchments;
- iii. No substantial investment will take place in the Delta and the communities will rely on their own resources.

### 17.2 Population

#### 17.2.1 Basic Characteristics

The SEA has examined the prospects for future population growth in the Delta which are influenced by both natural demographic characteristics and inward migration. The conclusion reached is that the present number of people living in the Delta will increase from 102,000 to 174,000 by 2030 and to 315,000 by 2050. At present it is estimated that 65,000 people live in settlements along the terraces, with a further 35,000 living within the floodplain. Fewer than 2,000 people live in the coastal zone (Odhengo *et al*, 2014a).

Based on the overall growth projections at 3% increase per annum the distribution of population in the Delta in 2030 and 2050 is shown in **Table 17.1**. Actual distribution of population within the Delta will vary as a result of many variables including available land, competition for land and water, the planning policies that are introduced to manage growth and natural events (floods and droughts). However, the allocation shown in **Table 17.1** provides a convenient basis for discussing such influences and the preferred distribution as discussed in the Hybrid Scenario.

#### 17.2.2 Household Formation

Over the next 20-40 years there are certain to be major changes in demography, but for planning purposes it is assumed that the number of households will increase in line with the existing relationships. This means that the number of households will increase from 19,885 in 2010 to 33,550 in 2030 and 60,595 in 2050.

### 17.3 Economic Activity

Livelihoods in the Delta are centred on the following areas of economic activity:

1. Livestock rearing
2. Farming
3. Fishing
4. Bee-keeping
5. Harvesting of Natural Resources
6. Tourism
7. Trade
  - Wholesale and Retail
  - Commerce and Financial Services
8. Mining & Industry
  - Mining and Quarrying
  - Manufacturing
9. Infrastructure
  - Services
  - Transport
10. Administration and Professional Services
11. Urban Areas
12. Water
13. Nature Conservation

Each of these activities is examined in more detail in the sections that follow.

### 17.4 Livestock

Two categories of livestock rearing are considered:

- Open grazing of cattle, goats and sheep on unfenced grassland, and,
- Grazing within ranches.

#### 17.4.1 Open Grazing of Livestock

##### 17.4.1.1 Area and Extent

It is assumed that pastoralists will seek to increase the number of livestock herded wherever possible, although the total area of land suitable for grazing is finite. Current numbers of livestock that are grazed within the Delta are shown in **Table 17.2**, together with the equivalent number that would be needed to maintain the same ratio that exists with the current population, as the resident population of the Tana Delta grows.

The current (2010) ratio of the number of animals per household is 21.3 cattle; 13.2 sheep, 11.9 goats and 0.036 camels for every pastoralist household and the numbers of each type of livestock has been projected

**Table 17.1 Population Levels in 2010 Projected to 2030 and 2050**

Location	2010	2030	2050
Terraces	65,000	111,000	20,1000
Floodplain	35,000	60,000	10,8000
Coast	2,000	3,000	6,000
<b>Total</b>	<b>102,000</b>	<b>174,000</b>	<b>31,5000</b>

**Table 17.2 Numbers of Livestock and Equivalent TLU in 2010, Projected to 2030 and 2050**

Livestock	2010		2030		2050	
	Number	TLU	Number	TLU	Number	TLU
Cattle	211,858	148,301	357,307	250,115	645,339	451,737
Sheep	131,154	13,115	223,430	22,343	403,537	40,354
Goats	118,676	11,868	203,118	20,312	366,852	36,685
Camels	360	360	609	609	1,100	1,100
<b>Total</b>		<b>173,644</b>		<b>293,379</b>		<b>529,876</b>

**Table 17.3 Water Consumption per Day (All livestock)**

All Livestock	2010	2030	2050
Total daily water intake (million m <sup>3</sup> ) Wet season	3.5	4.84	8.74
Total daily water intake (million m <sup>3</sup> ) Dry season	12	12	12

forward to 2030 and 2050 based on the forecast population increase.

It must be stressed that these figures simply show the number of animals that would need to be kept within the Delta in order to allow each household to maintain the same number of animals as they did in 2010. Whether this is feasible in terms of carrying capacity, (i.e. availability of land and water) is examined in the SEA. It should be noted that the estimates in **Table 17.2** are based on the minimum number of animals present in the Delta in 2010. The baseline analysis calculates that for cattle, the number of additional animals which may be driven into the Delta in drought periods may exceed half a million. This seasonal increase is not included in the projection of resident livestock numbers shown in **Table 17.2**.

#### 17.4.1.2 Water Demand

Using the same consumption figures generated in section 16.4.2, the daily water demand for cattle and other livestock would increase as shown in **Table 17.3**.

#### 17.4.1.3 Employment and Livelihoods

The number of FTEs based on one herder per 100 animals would rise from 1,736 in 2010 to 2,934 in 2030 and 5,299 in 2050.

#### 17.4.1.4 Economic Value

If it is assumed for the purposes of Scenario A that the increase in the number of livestock could be physically accommodated and that the current average price for cattle is applied, the relative value of the cattle alone in each of the three reference years is shown in **Table 17.30**.



**Table 17.4 Indicative Value for Resident Cattle in the Delta**

Year	Number of Resident Cattle	Value of Resident Cattle in Ksh
2010	211,858	2,542,296,000
2030	357,307	4,287,684,000
2050	645,339	7,744,068,000

**Table 17.5 Livestock Rearing on all Ranches**

Area of All Ranches	TLU at stocking densities	No of Cattle	No of Goats	No of Sheep
193,065				
3 ha/head	64,355	58,505	27,029	30,890
7 ha/head	27,581	25,098	11,584	13,239

**Table 17.6 Livestock Rearing on Ranches within the Delta**

Ranches within Delta	TLU at stocking densities	No of Cattle	No of Goats	No of Sheep
9,200				
3 ha/head	3,067	2,791	1,288	1,472
7 ha/head	1,314	1,196	552	631

## 17.4.2 Grazing on Ranches

### 17.4.2.1 Area and Extent

Five of the major ranches in the region lie within the Delta Plan Buffer Zone, two of which extend into the core area on the terraces between Idsowe and Tarasaa. A sixth ranch lies wholly within the southern floodplain. According to the LUP Baseline Report (Odhengo *et al*, 2013); only one of these ranches (Ida-sa-Godana) is currently grazed with a small number of cattle (240), goats (112) and sheep (128).

A significant proportion of ranch land has been leased to external companies like Bedford Biofuels, although the current status of these agreements is in doubt following that company's withdrawal from its experimental planting of *Jatropha* on 10,000 ha.

Under Scenario A it is assumed that the owners, who are either absentee landowners or elite members of existing communities, will seek to intensify levels of use, based on stocking the ranches to the limits of their carrying capacity in terms of forage and water. These aims may be challenged by other community members and by squatters on the land but for the purposes of

the scenario it is assumed that full stocking will occur as shown in **Tables 17.5 and 17.6**. The combined area of the ranches amounts to 193,065 ha of which 9200 ha lies within the core area of the Delta.

The number of livestock that could be kept on the ranches has been estimated by applying standard Tropical Livestock Units (TLU)<sup>5</sup> to the grazing categories for Semi-Arid and Arid rangeland in Kenya. Studies show that the carrying capacity for such areas varies between one TLU for every three to seven hectares. Applying this information to the total area of the ranches generates a figure of between 27,580 and 64,355 TLU. The number of each type of livestock is based on the ratio of two cattle to one sheep and one goat, as recorded in 2010 (Odhengo *et al*, 2012c), which constitutes 1.6 TLU.

**Table 17.6** shows the same information but only for those ranch areas lying within the Delta core.

It is assumed that maximum carrying capacity is reached in 2050, with half this level being reached in 2030. This is an arbitrary allocation but provides the starting point for later analysis in the SEA of the consequences of this level

<sup>5</sup>One Tropical Livestock Unit is the equivalent of 250 Kg live weight for grazing animals. Ten sheep or goats, averaging 25 Kg in weight equate to 1 TLU; One camel equals a TLU while, cattle are typically only 0.7 TLUs. (Source: FAO)

of livestock rearing. The results of these calculations are shown in **Table 17.7** for all ranches, and **Table 17.8** for ranches within the Delta. As with all other estimates in the Scenarios the results simply show the consequences of applying certain assumptions. The practicality of achieving the respective estimates is tested separately

through the SEA. A key consideration in the SEA is the extent to which this level of increased stocking would displace grazing by wild herbivores and by other cattle which have currently have access to the ranch areas which are unfenced.

**Table 17.7 Potential Livestock Rearing on all Ranches in 2030 and 2050**

<b>Description</b>	<b>2010</b>	<b>2030</b>	<b>2050</b>
Tropical Livestock Units (3 ha/TLU)	264	32,178	64,355
Cattle (No)	240	29,253	58,505
Goats (No)	112	13,515	27,029
Sheep (No)	128	15,445	30,890
Tropical Livestock Units (7 ha/TLU)	264	13,791	27,581
Cattle (No)	240	12,549	25,098
Goats (No)	112	5,792	11,584
Sheep (No)	128	6,620	13,239

**Table 17.8 Potential Livestock Rearing on Ranches within the Delta in 2030 and 2050**

<b>Description</b>	<b>2010</b>	<b>2030</b>	<b>2050</b>
Tropical Livestock Units (3 ha/TLU)	264	1,533	3,067
Cattle (No)	240	1,395	2,791
Goats (No)	112	644	1,288
Sheep (No)	128	736	1,472
Tropical Livestock Units (7 ha/TLU)	264	657	1,314
Cattle (No)	240	598	1,196
Goats (No)	112	276	552
Sheep (No)	128	316	631

**Table 17.9 Water Consumption by Livestock on Ranches (million m<sup>3</sup>/year)**

<b>All Livestock</b>	<b>2010</b>	<b>2030</b>	<b>2050</b>
All ranches	0.0036	0.48	0.96
Ranch within the Delta	0.0036	0.025	0.05

**Table 17.10 Value of Cattle Potentially Carried on all Ranches**

Year	Number of Cattle	Value of Cattle in KSH
2010	264	3,168,000
2030	32,178	386,136,000
2050	64,355	772,260,000

**Table 17.11 Land Areas and Employment in Subsistence Farming in 2010, Extrapolated to 2030 and 2050**

Description/Year	2010	2030	2050
Population	102000	174,000	315000
All Households (5.2 occupants)	19885	33,462	60,577
Number of Farming Households	9927	16,731	30,288
Land Area (Ha) at 1.5 acres/HH	6,204	10,457	18,930
FTE Jobs/Livelihoods	12,409	20,913	37,861
Value of agricultural production KSh million (at 2001 prices)	62	105	189
Land Area (Ha) at 3 acres/HH	6,204	50,192	90,865
FTE Jobs/Livelihoods	12,409	41,827	75,721
Value of agricultural production KSh million (at 2001 prices)	62	209	379

#### 17.4.2.2 Water Demand

The respective water demand for the years 2010, 2030 and 2050 for livestock on all ranches and the ranch within the Delta is shown in **Table 17.9**.

#### 17.4.2.3 Employment and Livelihoods

On the assumption that the ranches would be partially fenced fewer herders would be required than on open grazing areas. Consequently the ratio has been reduced from one herder per hundred to one herder per two hundred head. The respective numbers are therefore 2 FTEs in 2010, 160 FTEs in 2030 and 320 FTEs in 2050.

#### 17.4.2.4 Economic Value

The current level of stocking on the ranch within the Delta has very little economic value, but if an estimate is made based solely on the number of cattle which could be accommodated in 2030 and 2050, the gross value of the stock would be KSh 16,740,000 a year in 2030 and KSh 33,492,000 in 2050.

The number of cattle that could be carried on the larger ranches outside the Delta would be heavily dependent on measures needed to exclude wild herbivores and livestock from within the Delta, which are allowed to graze freely over the ranch lands at the present time. Assuming, however, that the ranches were fenced and managed exclusively for cattle, the potential gross value of the stock is shown in **Table 17.10**.

## 17.5 Farming

In this section the order in which information is presented has been modified. The opening sub-section describes the area and extent of land utilised for farming. This is then followed by detailed descriptions of three types of farming practice; namely 17.5.2 Subsistence cultivation; 17.5.3, Individual and communal irrigation schemes and 17.5.4, Commercial farming. Finally, summary information on water demand, employment and livelihoods and economic value is produced for all three types of farming in the closing sub-sections.

### 17.5.1 Area and Extent

The analysis of farming areas set out in the Existing Situation (section 16.5) indicates that roughly 45% of the land in the Delta undergoes some form of temporary cultivation or harvesting as arable or rangeland. This is a much larger area (114,800 ha) than the land set aside for permanent farming under individual households' control (6,147 hectares). Population increase will require that the permanently cultivated area is increased by 70% (to 10,460 hectares) by 2030 and treble in size by 2050 (to a total of 18,930 hectares). These increases in permanent cultivation will serve only to maintain a ratio of 1.5 acres per household. They would not tackle the continuing problems of food shortages for more than 20% of the population. Realistically the area in permanent cultivation would need to be doubled (i.e. 3 acres/1. Ha) per household to achieve self-sufficiency in food.

A number of different farming models are practised within the Delta including:

- Subsistence cultivation by individual families,
- Individual and Communal irrigated farming,
- Commercial farming enterprises (e.g. TARDA)

**Table 17.11** shows the areas assumed to be under subsistence cultivation in 2010, and the increase in permanent cultivation required to maintain 1.5 acres/household and to increase this to 3 acres/household. The table also shows the number of related FTE jobs created in 2030 and 2050 (based on 2 FTEs /1.5 acres and 4 FTEs/3 acres).

Under Scenario A it is assumed that future development of subsistence farming will be designed to remove the basic causes of poverty by providing 3 acres of land per household.

### 17.5.2 Subsistence Cultivation

This form of farming is undertaken by the majority of Pokomo people and a small number of farmers from other ethnic groups including Orma. As estimated in the baseline, the average size of land parcel farmed by a family is 1.5 acres (see 16.5.1.2). It is difficult to quantify the full level of labour expended on subsistence agriculture. Most of the hard labour, including ploughing, digging, planting, harvesting and watering is undertaken by women, but other family members including children will assist at key seasons including planting and harvesting. For the purposes of Scenario A it is assumed that each 1.5 acre plot will be maintained by one woman committing the equivalent of one Full Time Equivalent (FTE) job, supported by a number of family members working part-time (representing a further 1 FTE). The increasing number of livelihoods supported by expansion in the area of subsistence farming is shown in **Table 17.11**.

### 17.5.3 Individual and Communal Irrigation Schemes

A number of individual farmers have irrigated small areas of land by digging ditches to channel water to their plots or tree orchards from the River Tana or areas of semi-permanent wetland. They have also used small mobile water pumps and hoses to achieve the same results. In addition, groups of farmers and villagers have sometimes combined forces to excavate new canals or brooks to divert larger amounts of water. These exercises have not always been successful and in some cases they have had unintended consequences including diversion of the main river flow, or allowing incoming tides to push saline water into wetland farming areas. **Table 17.12** shows the extent of existing irrigation schemes and makes assumptions about the potential for adding to the existing network.

**Table 17.12 Areas Under Small Scale Irrigation in 2010, Extrapolated to 2030 and 2050**

Description	2010	2030	2050
Pumped Irrigation	50	300	500
Gravity-fed irrigation	335	700	1,500
<b>Total</b>	<b>385</b>	<b>1,000</b>	<b>2,000</b>

### 17.5.4 Commercial Farming Enterprises

The area under commercial cultivation in the Delta is currently restricted to around 1,000 acres (405 ha) on the north eastern part of the TARDA land holding, although only part of the area is productive. In theory, this area could be extended onto land in the Lower Delta. In practice, there are severe limitations affecting the cultivation of the latter area, including lack of a suitable irrigation supply and high risks of flood inundation and destruction of infrastructure if gravity fed irrigation were to be extended into this area.

Under Scenario A it is assumed that the potential of the existing farming area in the Upper Delta (between the Primate Reserve and Garsen – Witu Road) will be realised through cultivation of areas that are currently fallow, improved management and husbandry and the use of better crop varieties. The total area of potential arable land on the eastern side of the Upper Delta is over 2,000 hectares, and it is assumed that all of this land will be brought into use either as commercial or community- based farmland. **Table 17.13** shows a potential programme for expansion of this area from the current 385 hectares to 2,000 hectares. No additional commercial farming areas are added to the south of the Garsen-Witu road. Instead, that area would become a new development area for community and subsistence farming. Current yields for rice are 3.5 tonnes per hectare, while for maize are around 1.5 tonnes per ha. It is assumed that Rice yields can be increased to 5 tonnes per hectare by 2030 and then 7 tonnes/ha by 2050 while Maize increases to 3 and then 5 tonnes/hectare over the same time horizons.

### 17.5.5 Water Demand

Under existing practice, most subsistence cultivation takes place on rain-fed land or areas previously flooded during the wet season. It is assumed that there is no change under Scenario A. Consequently there would be no increase in water demand. On the other hand, areas under irrigation for rice would require around 700 mm over a growing season of 150 days. The gross amount and daily requirements are shown in **Table 17.14**.

**Table 17.13 Commercial Farming Practice in 2010, Extrapolated to 2030 and 2050**

Description	2010			2030			2050		
	Area (Ha)	Yield (Tonnes)	Value (USD)	Area (Ha)	Yield (Tonnes)	Value (USD)	Area (Ha)	Yield (Tonnes)	Value (USD)
Rice	70	250	125,000	200	1,000	500,000	400	2,800	1.4 m
Maize	315	470	110,000	800	2,400	550,000	1600	8,000	1.8 m

All prices based on Mundi (2013)

Rice : 500\$/tonne

Maize: 230\$/tonne

**Table 17.14 Water Demand for Irrigated Crops**

Parameter	2010	2030	2050
Gross demand (million m <sup>3</sup> /year)	2.7	7	14
Daily demand over 150 day growing season (m <sup>3</sup> /day)	1,7966	46,666	93,333

**Table 17.15 Employment/Livelihood in Agriculture**

Type of Farming	2010	2030	2050
Subsistence cultivation	12,409	41,827	75,721
Commercial /Irrigated	77	200	400
<b>Total</b>	<b>12,486</b>	<b>42,027</b>	<b>79,721</b>

Assessment Criteria	Year		
	2010	2030	2050
All Households in Delta	19,885	33,550	60,595
Farming HH in the Delta	9,943	16,775	30,298
Nominal value of food produced KSh Million	183	309	557

**Table 17.16 Gross Value of Agricultural Produce (KSh Million)**

Type of Farming	2010	2030	2050
Subsistence cultivation	183	309	557
Commercial /Irrigated	20	84	269
<b>Total</b>	<b>203</b>	<b>393</b>	<b>826</b>

**Table 17.17 Freshwater and Marine Fisheries in 2010, Extrapolated to 2030 and 2050**

Description of fishing activity	2010		2030		2050	
	Yield (kg)	Value KSh Million	Yield (kg)	Value KSh Million	Yield	Value KSh Million
Fresh water	394,000	34278000	500,000	43500000	750000	65250000
Marine	220,000	220,087	250,000	21750000	275000	23925000
<b>Totals</b>	<b>614,000</b>	<b>34,498,087</b>	<b>750,000</b>	<b>65,250,000</b>	<b>1,025,000</b>	<b>89,175,000</b>



### 17.5.6 Employment and Livelihoods

The cumulative totals for the number of livelihoods /jobs created by expansion of subsistence farming are shown in **Table 17.11** and an estimate of jobs in commercial farming based on one FTE per five hectares of rice paddy/maize cultivation, has been added to these in **Table 17.15**.

### 17.5.7 Economic Value

The value of food produced for subsistence has been estimated using the formula applied in paragraph 16.5.4.

**Table 17.16** draws together the information on gross value of both subsistence cultivation and communal and commercial farming.

## 17.6 Fishing

### 17.6.1 Freshwater and Marine Capture Fisheries

#### 17.6.1.1 Area and Extent

Fishing for freshwater species has declined in recent years due to the impact of reduced flood flows on spawning and food sources in both the main river channels but also in ox-bow lakes and other natural water bodies (Nature Kenya, 2012). Marine fishing has not been affected so severely, although reductions in the amount of silt and organic debris reaching the mouth of the River Tana are thought to have had some effect on fishing in the coastal zone. **Table 17.17** shows current levels of production in 2010, together with extrapolated (arbitrary) growth in supply in 2030 and 2050. Both freshwater and marine fisheries are assumed to contribute to the increase in yield and value of fish caught. The increases shown in **Table 17.17** are arbitrary values.

#### 17.6.1.2 Water Demand

The critical issue for all forms of fishing and fish farming relates to the availability of good quality water at essential periods in the fish breeding and rearing cycle. Precise quantities cannot be estimated but the basic requirement to satisfy maintenance of healthy river and oxbow lake fisheries will be preservation of the environmental reserve and minimum flow of 60m<sup>3</sup>/sec in the River Tana.

#### 17.6.1.3 Employment and Livelihoods

The number of livelihoods supported by both types of fishery is estimated in **Table 17.18**, using the same criteria set out in section 17.6.3.

#### 17.6.1.4 Economic Value

Estimates of the value of fish catches are shown in **Table 17.17**.

### 17.6.2 Aquaculture

In line with the overall emphasis on extending existing livelihoods, it can be anticipated that fish farming would become more important over time and allowance is made for the creation of one fish farm in 80 villages over the plan period.

#### 17.6.2.1 Area and Extent

Each fish farm would consist of five ponds, each with an average size of 500m<sup>2</sup>. Further details are set out in section 18.6.

#### 17.6.2.2 Water Demand

Fish farms would be supplied with water direct from the River Tana. There would be losses through seepage and evaporation, but on a scale commensurate with normal flows through the Delta.

#### 17.6.2.3 Employment and Livelihoods

Eighty (80) full time job equivalents would be created for permanent workers, with a requirement for part-time assistance in harvesting the catch.

#### 17.6.2.4 Economic Value

It is assumed that up to 5.5 tonnes of fish a year could be harvested by each village community at an average price of 35KSh/Kg yielding a total of KSh 15.4 million.

## 17.7 Bee Keeping

### 17.7.1 Area and Extent

There is considerable potential to expand areas of forage for bees and to increase the number of hives in each community and this Scenario assumes that the current scale of production of honey is doubled by 2030 and trebled by 2050 (See **Table 17.19**). However, the capacity to increase production will be governed in practice by the condition of forests, woodlands and other areas with extensive acacia and other flowering tree species. If these areas are cleared to make way for other land uses, these yields could not be sustained.

### 17.7.2 Water Demand

Bees require access to water at all times of the year but the quantities are not significant at a delta-wide scale.

### 17.7.3 Employment and Livelihoods

The number of full time jobs that could be created in beekeeping is estimated at 140 in 2010, 480 in 2030 and 720 in 2050. Based on part time beekeeping to supplement other forms of income, with an average yield of 50 kg per beekeeper the numbers would be 1,460, 4,800 and 7,200 respectively.

**Table 17.18 Employment in Freshwater and Marine Fisheries**

Type of Activity	2010	2030	2500
Inland fisheries	250-500	666	1,000
Marine fisheries	200	333	366
<b>Totals</b>	<b>450-700</b>	<b>1,000</b>	<b>1,366</b>

**Table 17.19 Projections of Honey Production from 2010 to 2030 and 2050**

Year	2010	2030	2050
No of Hives	12,150	24,000	36,000
000 Kgs	68-96	240	360
KSh Million	20-29	72	180

**Table 17.20 Employment and Livelihoods in Natural Resource Harvesting**

Source of employment/Livelihood	2010 (FTE)	2030 (FTE)	2050 (FTE)
Harvesting	4,971	8,365	15,144
Building Construction	540-725	1,295-1,740	2,878-3,863
Charcoal and Fuel wood	4,971	8,365	15,144
<b>Total</b>	<b>10,482-10,667</b>	<b>18,025 – 18,470</b>	<b>33,166-34,151</b>

**Table 17.21 Income from Non Timber Forest Products and Wetlands in 2010, 2030 and 2050**

Description	2010	2030	2050
No of harvesters	4971	8365	15144
Gross Value (KSh million)	80	134	242

Category	2010	2030	2050
Total number of households	19885	33550	60595
Number of Households (in Pokomo & Orma Communities)	9943	16775	30298
Pokomo (New and rebuild) KSh million	66	111	201
Orma (New and rebuild) KSh million	34	57	104
Value of housing construction and repair (KSh million)	100	169	305

#### 17.7.4 Economic Value

The value of annual production is shown in **Table 17.19**.

### 17.8 Natural Resources

#### 17.8.1 Area and Extent

A wide variety of fruits, nuts, fungi, honey, medicinal plants and building materials are harvested from the marshes, reed beds, grassland and forests of the Tana Delta, as discussed under the existing situation. Opportunities to extend the current level of activity might exist if the forests and woodlands are managed sustainably, but this would depend upon finding alternative energy sources to charcoal and firewood as discussed in the SEA.

#### 17.8.2 Water Demand

As noted in the Existing Situation analysis, water is literally vital to the healthy growth of vegetation which underpins all forms of natural resource exploitation. The forests, swamps, grasslands and other habitats of the Tana Delta are a direct product of the historic pattern of rainfall, flooding and normal flows in the River Tana. Consequently current demand directly matches the River Tana's natural flow regime.

#### 17.8.3 Employment and Livelihoods

Information on the value created under the different headings of harvesting fruits, house construction and charcoal and fuel wood production is given in Tables 17.22-24. It is summarised below in **Table 17.20**. The number of full time jobs in house building has been calculated by comparing the number of jobs created in 2010 (Odhengo *et al*, 2012a) with the value of materials and arriving at a range between KSh 447,724 and 601,111 per job and then grossing up the numbers of jobs against the material costs in 2030 and 2050.

#### 17.8.4 Economic Value

Taking the formula adopted for existing situation of 1 individual per 4 households deriving an income of KSh16,000/annum from natural products the gross income for the Delta is shown in **Table 17.21**.

The main uses of natural resources would continue to be for:

1. building materials (Grass/reeds/poles/ withies [for weaving] /mud and skins,
2. Fuel (charcoal and firewood)
3. food
4. water

**Table 17.22 Annual Consumption of all Natural Building Materials in 2010, 2030 and 2050**

2010			
Material	Unit	Annual Quantity	Annual Cost (KSh million)
Mud/Earth	Trip	3,882	27.2
Grass	Bundle	652,900	19.6
Reeds	Bundle	457,030	18.3
Palm leaves	Piece	1,941,000	194.1
Palm Rope	Bundle	24,234	2.4
Poles	Piece	1,576,400	63.1
			324.6
2030			
Material	Unit	Annual Quantity	Annual Cost (KSh million)
Mud/Earth	Trip	9,317	65
Grass	Bundle	1,566,960	47
Reeds	Bundle	1,096,872	44
Palm leaves	Piece	4,658,400	466
Palm Rope	Bundle	58,162	6
Poles	Piece	3,783,360	151
			779
2050			
Material	Unit	Annual Quantity	Annual Cost (KSh million)
Mud/Earth	Trip	20,691	145
Grass	Bundle	3,479,957	104
Reeds	Bundle	2,435,970	97
Palm leaves	Piece	10,345,530	1,035
Palm Rope	Bundle	129,167	13
Poles	Piece	8,402,212	336
			1,730

Note: Combines both Pokomo and Orma Housing Requirements (New Build and Repairs/Reconstruction)

**Table 17.23 Charcoal and Firewood Production in 2010, 2030 and 2050**

Year	2010	2030	2050
Population	102000	174,000	315000
All Households (5.2 occupants)	19885	33,462	60,577
25% of Households engaged	4,971	8,365	15,144
Charcoal			
Thousand Tonnes	37-57	64-100	116-180
Woodland (000 Hectares)	44-68	77-120	139-216
Value (KSh Million)	130-200	270-420	487-756
Firewood (25%)			
Thousand Tonnes	9.2-14.2	16-25	29-45
Woodland (000 Hectares)	11-17	19-30	35-55
Value (KSh Million)	23-36	40-63	73-112
Charcoal & Firewood Combined			
Thousand Tonnes	46.2-71.2	80-125	145-225
Woodland (000 Hectares)	55-85	96-150	174-271
Value (KSh Million)	153-236	310-483	560-868

### 17.8.5 Building Materials

Table 17.22 takes the information on consumption of natural materials for housing construction from the existing situation (see section 16.8.6). By 2030, the number of new houses being constructed each year will have risen from 600 to 1,000 and by 2050, the annual completion rate will need to be over 1,800 houses. Repairs and reconstruction are assumed to rise on an equivalent basis.

By 2030 the value of annual house construction will have risen from KSh 100 million to KSh 169 million, with a further increase to KSh 305 million by 2050.

#### Charcoal and Fuelwood:

Table 17.23 shows the consequences of increased population levels in the Delta in terms of the demand for charcoal and fuel wood on the assumption that there is no substitution of energy sources in **Scenario A**.

## 17.9 Tourism

### 17.9.1 Area and Extent

The potential of the Tana Delta to attract visitors on eco-tourism trips to see the coastline, mangroves, forests and grasslands of the floodplain is very high. However, the current level of activity in the Tana Delta is low despite its considerable attractions. The main reasons

for low activity are limited capacity in management, low public awareness and lack of marketing and the perceptions of security risks arising from recent conflicts in the coastal region and Delta. Under Scenario A these constraints are not expected to change significantly in the coming decades. This is because rising population will accelerate the competition for land and water leading to intensification of the current social unrest. In consequence only slight increases in tourism activity are projected. (See Table 17.24)

### 17.9.2 Water Demand

There would be no significant increase in water demand by tourism under this scenario.

### 17.9.3 Employment and Livelihoods

The number of full time equivalent jobs would rise from 200 in 2010, to 400 in 2030 and 600 in 2050.

### 17.9.4 Economic Value

Growth in turnover is shown in Table 17.24.

## 17.10 Trade, Commerce and Financial Services

### 17.10.1 Wholesale and Retail Trade

Under Scenario A there would be few incentives for expanding the wholesale and retail trade beyond the

requirements created by an expansion in the absolute number of people living in the Delta. Initially, the increase in population could be expected to increase the volume of trading activity but as pressure on resources increase, the value of trade per capita would fall, matching increasing levels of poverty and destitution.

#### 17.10.1.1 Area and Extent

The full range of activities discussed in the baseline situation would continue to apply. Transportation would remain a major activity including both road and water-borne transport of people and goods. Trading and marketing would also continue to represent a major part of the local economy, reflecting the production of fruits like mangoes, surplus food crops, fish, milk and meat products and their sale to communities in the arid areas surrounding the Tana Delta. Import of cloth, tools, utensils and other staple food products would continue to take place to supplement what people in the Delta could produce for themselves. In addition, there are a range of standard activities found in any rural and semi-urban communities like banking and micro-credit, machinery repair and ironmongery, tailoring, water and beverage sales, electricity and tele-communications. The main market centres would remain at Garsen and Witu although Tarasaa and several roadside junctions also have stores. **Table 17.25** illustrates this element of the local economy.

#### 17.10.1.2 Water Demand

As noted under the Existing Situation, any demand for water from trading commerce and financial services is very low and subsumed with the estimates for domestic use.

#### 17.10.1.3 Employment and Livelihoods

Under the existing situation analysis in Chapter 16 the number of full time job equivalents in trade is estimated at 3,488 FTEs. Pro-rata increase in trading activity based on household formation gives an estimated 5,870 FTEs in 2030 and 10,628 FTEs in 2050. Under Scenario A it is assumed that the share of transportation, trading and marketing in the local economy will grow in proportion to the overall size of the population.

#### 17.10.1.4 Economic Value

The increase in trading activity for individual households is shown in **Table 17.25**.

Taking the growth of trading, wholesale and retail activities as a complete sector the increase in economic value is assessed by applying pro-rata rates based on the share of the national economy (see section 15.4.5 for basis of the calculation). Assuming that trade accounts for 10.8% of GDP, the equivalent figures for the Delta would be KSh 1,243 million in 2030 and KSh 1,588 million in 2050.

**Table 17.24 Levels of Tourism Activity with turnover in US\$ in 2010, 2030 and 2050**

Description	2010	2030	2050
Number of international visitors	275	500	1,000
Turnover generated by international visitors	16,500	30,000	60,000
Number of national visitors	5,225	10,000	15,000
Turnover generated by local visitors	26,125	50,000	75,000

**Table 17.25 Trading and Marketing in the Delta in 2010, 2030 and 2050**

Description	2010	2030	2050
All households	19,885	33,462	60,577
Trading component per household KSh	3,753-5,756	3,753-5,756	3,756-5,756
Income generation for all households (KSh millions)	74-114	126-193	227-349



### 17.10.2 Professional Services

A very small number of people are employed within the Delta in professional fields such as banking, teaching, surveying and veterinary services, etc. The number of professionals would increase proportionately to the growth in population but there would be no incentives to attract more teachers, nurses and doctors or other skilled workers to the area.

### 17.10.3 Public Administration

The public sector includes staff working for the County Governments (formerly employed in district positions by the national government). As in the case of professional services, this sector currently makes up only a small component of economic activity although under the newly devolved functions of County Governments its importance will grow. Nevertheless, unless the economy of the Tana Delta was to grow significantly, which is unlikely under Scenario A, the level of public administration would remain low relative to other counties. Applying the national equivalent contribution to GDP of 11.1% gives a figure of KSh 1,277 million in 2030 and KSh 1,632 million in 2050.

## 17.11 Mining and Industry

### 17.11.1 Area and Extent

Mining activities are minimal in the Delta at the present time. There is harvesting of sand and sea salt especially in the Southern part of the District. There is also the potential for titanium prospecting in the Delta. The area and extent of mining activity could increase under Scenario A, regardless of the pattern of other land use activities being considered.

Industrial activities are also very minimal at present. The main rice mill has recently been rehabilitated and is managed by TARDA but is only operating at about 30% of its capacity due to low rice production. Most commercial activities are of cottage industry scale or are informal in nature and include furniture making, mat making, home based oil extraction and butter making. These form part of the subsistence economy and would continue to represent the main economic activities under Scenario A.

### 17.11.2 Water Demand

The current level of industrial and mining activity in the Tana Delta does not generate a significant water demand and the extent to which new development might alter this would depend on the type of minerals being exploited.

### 17.11.3 Employment and Livelihoods

With the exception of salt processing, for which an estimated 50 FTEs are involved, the contribution of

this sector to employment and incomes is minimal. Exploration has recently commenced for oil and gas within the Lamu section of the Tana Delta. Performance of the rest of the local economy would not be a critical factor in determining whether or not the industrial and mining sector expanded under **Scenario A** but any growth would have limited benefits for the local community in the absence of skills training and higher overall educational attainment for the majority of residents. Local people would continue to find it difficult to secure employment in industry and mining because companies would prefer to hire well trained specialists from outside the Tana Delta.

Communities living in the Delta are engaged in various economic activities ranging from crop farming, livestock keeping, fishing, informal trade and seasonal and formal employment (See **Table 17.26**).

**Table 17.26: The Economic Activities of Tana River Delta Communities**

Occupation	Percent (%)
Herdsman (pastoralists)	38.9
Keeping livestock	8.3
Business man/woman	1.7
Farming and livestock	8.9
Farming	35.6
Employed	6.7
<b>Total</b>	<b>100.0</b>

Source: HVA International, 2007

### 17.11.4 Economic Value

The world price ex mine for sea salt in 2010 was USD 180/tonne according to the US Geological survey. No significant increase in mining activity is anticipated under Scenario A so the value of estimated production from the Delta area would remain around USD 3.06 million.

## 17.12 Infrastructure

### 17.12.1 Services

The Tana Delta has the benefit of a major road passing round its perimeter and linking Malindi (and the rest of the southern coastal towns) to Garsen, and Lamu. However, until the advent of the LAPSET corridor and Lamu Port project, this route had been seriously neglected and even today some parts of the road are severely pot-holed – especially the extension north to Hola and Garissa.

The remainder of the road network in the Delta to Tarasaa, Kipini and other areas within the Delta are gravel-bound or beaten earth.

Electricity supplies to the principal settlements have been significantly upgraded with the construction of a new national grid powerline linking Mombasa and Lamu. Much of the rural area is without electricity.

### 17.12.2 Transport

There would continue to be improvements to infrastructure under Scenario A, driven by the economic investments being made in adjoining counties, including the Lamu Port development. However, it would be difficult to make a strong case for new road building within the Delta Plan Area if subsistence agriculture and traditional forms of cattle rearing continued to be the mainstay of the economy, since there would be relatively little import-export traffic.

An assessment of the value of transport and communications to the Tana Delta economy is made by applying the pro-rata national contribution of 12.4% of GDP. This yields figures of KSh 1,427 million in 2030 and KSh 1,823 million in 2050.

### 17.13 Administration and Professional Services

There is a small public administration operating within the Tana Delta including County Government employees, workers from the Government parastatal organisations, teachers and doctors / nurses attached to local clinics. A guide to the value of administration and professional services, including health and education is given by applying the national percentage of this sector (11.1%) to the Tana Delta local economy. This yields figures of KSh 1,277 million in 2030 and KSh 1,632 million in 2050. However, these estimates probably over-emphasise the returns from this sector because in the absence of significant growth in the economy under Scenario A wages would remain low and many posts,

lying in isolated areas would remain unattractive to career-conscious public sector workers.

Similar concerns would affect professional workers and there would be few incentives for establishing small private companies given the limited markets that would exist within the Delta.

### 17.14 Urban Areas

The existing centres of Garsen, Witu, Tarasaa and Kipini, amongst others, would continue to expand but without the impetus of major external investment. Based on a pro-rata increase in area to match the rising population, it is assumed that the urban area would grow from its present estimated 2,620 hectares to 4,400 ha in 2030 and 8,300 ha in 2050.

### 17.15 Water Resources

#### 17.15.1 Water Consumption

Water consumption will increase with rising population and the increase in farming and livestock rearing. The use of water is accounted for under each type of economic or livelihoods activity. There is therefore no separate breakdown of information under area and demand or employment. However, it is important to note that water has a real value, whether it is paid for as supplied by a public utility or received as a free good as rain or collected from a river. For this reason, the value of water is calculated in these scenarios at the same rate at which is charged to communities who rely on kiosks and standpipes which is KSh 100 per 1000 litres (1m<sup>3</sup>).

**Domestic Consumption:** The current low level of domestic water consumption, assumed to be 20 litres per head, (Mati, 2006) should rise on humanitarian grounds to a minimum of 40 litres per head by 2030 and to double this amount by 2050 (i.e 80 litres/head) (See **Table 17.27**). This is still only half the current per capita consumption in the major urban centres of Nairobi and Mombasa.

**Table 17.27 Domestic Water Consumption**

Population	2010	2030	2050
<b>Total</b>	102,000	174,000	315,000
<b>Water Consumption (M<sup>3</sup>/day)</b>	2,040	6,960	25,200
<b>Value (KSh 100/m<sup>3</sup>) in '000s</b>	204	696	2,520

**Table 17.28 Livestock Water Consumption**

Type of Livestock	Current (2010)	2030	2050
Cattle	211,858	362,227	654,219
Water consumption / day (M <sup>3</sup> )	4,237	7,245	13,084
Sheep	131,154	223,430	403,537
Water consumption / day (M <sup>3</sup> )	262	447	807
Goats	118,676	203,118	366,852
Water consumption / day (M <sup>3</sup> )	237	406	734
Camels	360	609	1,100
Water consumption / day (M <sup>3</sup> )	11	18	33
Total livestock water consumption / day M <sup>3</sup>	4,748	8,116	14,658

**Table 17.29 Water Demands for Farming and Irrigation**

Description	2010	2030	2050
Pumped Irrigation	50	300	500
Gravity-fed irrigation	335	700	1500
Total	385	1000	2000
Water demand M3/day (based on 1000 mm/m <sup>3</sup> /six months)	10,548	27,397	54,795
Value (KSh100/m3) in '000's	1,055	2,740	5,479

*Livestock watering* will also add significantly to overall water consumption, as shown in **Table 17.28**. Water consumption by Zebu cattle equates to 12-20 litres/head/day (FAO) while sheep and goats consume one tenth of this amount.

**Farming and Irrigation:** The expansion of subsistence and community farming areas will result in additional pumped and gravity irrigation schemes and create a demand for 27,000 m<sup>3</sup>/day in 2030, rising to a total of 55,000 m<sup>3</sup>/day by 2050.(See **Table 17.29**).

Total water consumption for all demands except the environmental reserve is shown in **Table 17.30**.

The equivalent flow rates to support this level of water abstraction are shown in **Table 17.31**.

Water consumption for all forms of abstraction begins to make an appreciable impact on available river flow by 2030 (taking 0.8% in 2030 and 1.8% in 2050). However direct abstraction is far less significant than

the requirement which would exist to provide sufficient water to maintain grassland and rangeland in a condition capable of sustaining the massive increase in stocking density. This is assessed separately in the SEA report. However, as described under the existing situation in section 16.12 most of the water which flows through the Idsowe Bridge is required to maintain the natural vegetation and grasslands of the Tana Delta during the dry season and any decrease in natural river flows below a monthly average of sixty cubic metres of water per second (60m<sup>3</sup>/sec) as a result of development upstream would rapidly affect the capacity of the system to maintain the livelihoods and biodiversity of the Delta. This figure of 60m<sup>3</sup>/second is referred to as the environmental reserve.

## **17.16 Nature Conservation and Biodiversity**

The assessment of nature conservation and biodiversity is divided into two sub-sections; the first considers opportunities for promoting development of the

**Table 17.30 Daily Demand for Water in 2010, 2030 and 2050**

Water Demand	2010	2030	2050
Domestic	2040	6960	25200
Livestock	4748	8116	14658
Irrigation	10548	27397	54795
Total M <sup>3</sup> /day	17336	42473	94653
Value KSh (Millions/year)	6.3	15.5	34.5

**Table 17.31 Effect of Abstraction on Tana River Flows**

Water Demand	2010	2030	2050
M3/sec	0.20	0.49	1.10

resource and its economic potential while the second deals with future challenges.

#### 17.16.1 Opportunities for Promoting Development

The scope for promoting nature conservation through economic development is extremely limited under Scenario A because all growth patterns (population, farming area, livestock numbers and natural resource consumption) will lead to significant land conversion, thus reducing the attractiveness of the Tana Delta to wildlife and to human enjoyment of the resource.

#### 17.16.2 Challenges

All forms of human activity in the Delta would impose increased stress on the natural environment by reducing the area of habitats and increasing demands for grazing, farming and water uptake.

##### Area and Extent

**Population growth:** Under Scenario A urban areas would expand from 26 km<sup>2</sup> to 44 km<sup>2</sup> in 2030 and 80 km<sup>2</sup> in 2050.

**Livestock increase:** Current stocking densities are close to, and at times exceed, the carrying capacity<sup>6</sup> of the Delta based on the conversion of natural vegetation to poorer quality grasses and heavy overgrazing which occurs in the dry seasons. If further increases in livestock density were to take place (See **Table 17.32**) this would cause significant competition and conflict with the native population of wild herbivores and will rapidly diminish the Tana Delta's value as an Important Bird Area and Ramsar site. It would also result in increased pressure on adjacent habitats (i.e. woodland and thicket and scrub).

Expansion in the size of the permanent cattle herd to over 350,000 head by 2030 would result in the loss of all natural habitats that sustain any form of grassland or scrub layer and would be incompatible with any attempts to continue to farm areas of the Delta for either subsistence or commercial purposes.

**Farming:** Up to 50 km<sup>2</sup> of scrub or thicket, would need to be cleared and converted to permanent cultivation by 2030 to support the level of subsistence farming required to feed the resident population (at 3 acres/household), with a further 40 km<sup>2</sup> being required by 2050. Based on the projections quoted above, biodiversity would be greatly reduced. Wildlife would be significantly affected through reduction in feeding areas, increased competition with livestock, human/wildlife conflict and overall disturbance of the habitats which could be reduced to less than 50% of their current extent. These issues are examined in more detail in the SEA Report.

#### 17.16.2 Wildlife corridors

Initially – for perhaps ten years or so – the five existing corridors used by migrating animals would continue to exist under Scenario A, but with expanding population and increased competition between farming and livestock rearing the level of human/wildlife conflict could be expected to increase rapidly. Eventually the point would be reached at which most large herbivores would cease to use the routes due to development, competition and encroachment by other land uses.

### 17.17 Summary

**Table 17.33** provides an overall summary of Scenario A which can be compared with the data given in the existing situation analysis.

<sup>6</sup>It must be stressed that the reference to carrying capacity in preceding paragraphs refers only to the notional capacity of the Tana Delta to provide sufficient grassland and water to sustain the number of TLU quoted. This assessment is purely for livestock and does not take into consideration the needs of any other forms of land use or economic activity, either present or planned within the Delta.

**Table 17.32 Prediction of Tropical Livestock Units in 2030 and 2050, and Equivalent Areas at Different Stocking Densities**

Livestock	2010		2030		2050	
	Number	TLU	Number	TLU	Number	TLU
Cattle	211858	148,301	357307	250,115	645339	451,737
Sheep	131154	13,115	223430	22,343	403537	40,354
Goats	118676	11,868	203118	20,312	366852	36,685
Camels	360	360	609	609	1100	1,100
<b>Total</b>		<b>173,644</b>		<b>293,379</b>		<b>529,876</b>
Range (in Km <sup>2</sup> ) needed at 1.75 TLU/ha		992		1676		3028
Range (in Km <sup>2</sup> ) needed at 1 TLU/Ha		1736		2934		5299
Range(in Km <sup>2</sup> ) needed at 1 TUL/ 3 Ha		5209		8801		15896
<b>Key to colour coding</b>						
Just within carrying capacity of the Delta						
Already exceeding the carrying capacity of the Plan Area						
Lying well beyond the carrying capacity of the entire Plan Area						



**Table 17.33 Summary of Scenario A**

Component	Measure/Unit	2010	2030	2050
Population	Thousands	102	175	315
Workforce	Thousands	52	87	158
Urban Area	Km <sup>2</sup>	26.2	34	49
Industrial land	Hectares	10	70	130
Open Grazing	Area occupied (Km <sup>2</sup> )	1,128	2,314	4,179
	Cattle- Maximum number	735,000	735,000	735,000
	Cattle - Minimum number	220,000	220,000	220,000
	Cattle - Average number	477,500	477,500	477,500
	Average value (KSh 12,000/head) in KSh Billion	5.7	5.7	5.7
Ranches (Delta)	Area occupied (Ha)	9,200	9,200	9,200
	Cattle - Maximum number (TLU)(3ha/hd)	530	530	530
	Cattle- Minimum number (TLU) (7ha/hd)	174	174	174
	Cattle - Average number (TLU)	352	352	352
	Average value of cattle (KSh Million)	3.2	3.2	3.2
Farming	Area Occupied (Km <sup>2</sup> ) 3 acres/HH	N/A	501	908
	Subsistence (Area Km <sup>2</sup> ) 1.5 acres/HH	62	104	189
	Subsistence farming (people supported '000s)	51	88	158
	Value of subsistence crops (KSh million)	183	309	557
	Irrigated land (Ha)	385	1,000	2,000
	Labourers ('000) based on area (1.5 or 3 acres)	12.4	31	56
	Commercial farm (Has)	450	1000	2,000
	Commercial farms value (KSh million)	20	84	269
Fishing	'000Kgs/annum	613	750	1,000
	Value (KSh million)	34.5	65	89
Aquaculture	Value of annual harvest (KSh million)	15.4	15.4	15.4
Bee keeping	Number of hives	12,150	24,000	36,000
	Honey (000 Kg)	82	240	360
	Value (KSh million)	25	72	180
Natural Products	Average area for required for harvesting (Km <sup>2</sup> )	70	123	222
	People engaged	4,971	8,365	15,144
	Income generated from NTFP (KSh million)	80	134	242
	Value of building (KSh million)	325	779	1,730
	Charcoal / Firewood - average ('000 tonnes)	58.7	102.5	185
	Value of Charcoal and Firewood (KSh million)	194	396	714
Tourism	Turnover (Value '000USD)	26	50	75
Industry & Mining	Area Involved	0.5	0.5	0.5
	Turnover KSh million	257	257	257
Water Demand	Domestic (m <sup>3</sup> /day)	2,040	6,900	25,200
	Commercial / Industrial (m <sup>3</sup> /day)	0	1,500	1,500
	Livestock (drinking) (m <sup>3</sup> /day)	4,784	8,116	14,658
	Farming (Plant uptake) (m <sup>3</sup> /day)	10,548	27,397	54,795
	Environmental Reserve (million m <sup>3</sup> /day)	5.2	5.2	5.2
Biodiversity	1407 Km <sup>2</sup> Prime Habitats = 100	100	<50	<50

# CHAPTER 18

## SCENARIO B – COMMERCIAL DEVELOPMENT

### 18.1 Introduction

Under **Scenario B** it is assumed that all forms of commercial development would be encouraged in the interests of stimulating the economy and regardless of any adverse social or environmental consequences. It is also assumed that population growth and demands for food and water identified under **Scenario A** would apply to **Scenario B**, in the absence of any planned intervention. In practice, the range of commercial development options would be constrained by competition for land, water and other resources but these issues are examined separately in the SEA analysis.

### 18.2 Population

Under **Scenario B** it is assumed that the projections for future population growth in the Delta are the same as in **Scenario A**.

### 18.3 Economic Activity

There is an extensive body of academic theory around the evolution of economic activity, beginning with the exploitation of natural resources in any region using hand tools and progressing to full mechanisation. Classic locational theory (Weber, 1909) emphasises the importance of transportation costs, labour costs and economies of scale in determining the location of heavy industry and applies particularly to bulky and heavy goods. Growing of cotton exemplifies these issues. It can only be grown in hot or tropical conditions with adequate water, but processing involves the use of capital intensive equipment (Ginning mills). Trading and trading partnerships become important in fixing the location of secondary or indirect economic activity, including value addition in converting the raw product into textiles. With refined products the location of subsequent manufacturing processes can become even more flexible and external influences like perception and fashion become important, hence the emergence of cities like Milan in Italy as world leaders in clothing production, even though they are now far removed from the source of raw materials.

Traditional theories of industrial location have less relevance for many modern forms of high technology economic activity like computer manufacturing where access to high levels of educational attainment, skilled operatives and research institutions becomes critical combined with scope for meeting high quality lifestyles of key workers. Nevertheless the traditional theories of

industrial location still apply and have been reworked in a number of countries using the concept of 'clustering'. This approach recognises that there are major economic advantages in grouping related businesses in the same area. These principles have been applied in developing the vision for LAPSET. Surveys have been undertaken to identify existing core activities in North East Kenya and the findings have been used to develop specific 'cluster' concepts for towns and sub-regions in the LAPSET corridor. A number of the 'business case projections' have direct relevance to the Tana Delta and have been used to support the development of this scenario.

The River Tana and the Tana Delta are, themselves, a potential major resource for the Port of Lamu and the new economies of the sub-region. A rapidly growing population in the new town, rising to a projected 1.5 million people by 2050, will create demands for the whole range of consumer goods, including food, water, building and construction materials, furnishings, white goods, educational, medical and leisure facilities. Many of these consumables will be imported, given the opportunities that the port will create for trade with the Middle East and Asian economies. However, Tana Delta and the coastal belt is particularly well placed to provide perishable food, meat and dairy products to this growing market given the sub-region's high temperature, moderate rainfall and potential stored water supplies (through development of the High Grand Falls Dam and associated balancing reservoir, providing this essential component is included in the eventual development plan).

A logical extension to the production of perishable food is the manufacture of canned and containerised meat and food products, and the existing role of Garsen as a livestock trading market exporting cattle on the hoof to other regions could be transformed through construction of processing factories to add value directly to the food chain. For all of these reasons opportunities to maximise on production of natural resources should be seen as the prime area for initial investment. Other cash crops and industrial crops could also be developed to serve national and international markets, although these may conflict with other aims for environmental protection and social development in the Tana Delta.

Another very important consideration in examining development opportunities in the Tana Delta and lower River Tana is the role of transport. At present, road

**Table 18.1 International Standard Industrial Classification – Main Sections**

Section	Description
A	Agriculture, forestry and fishing
B	Mining and Quarrying
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply
E	Water supply, sewerage, waste management and remediation activities
F	Construction
G	Wholesale and retail trade, repair of motor vehicles and motorcycles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance services
L	Real estate activities
M	Professional, Scientific and technical services
N	Administrative and support service activities
O	Public administration and defence, compulsory social security
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities
T	Activities of households as employers, undifferentiated goods and services producing activities of households for own use
U	Activities of extraterritorial organisations and bodies

conditions are poor; notwithstanding the recent upgrade to the road between Garsen and Lamu. However, major improvements are planned to the road infrastructure which will result in Garsen occupying a key strategic location at the junction of the Mombasa – Lamu main road, and the northern route from Nairobi, through Garissa and Hola to the coastal port. Expansion of the high voltage electricity grid has recently taken place with a new 440 Kv power line extending from Malindi to the Port.

The juxtaposition of road transport, electricity, water supplies, natural resources and extensive areas of level land which is physically suitable for industrial and commercial development all favour the selection of the Garsen area as a focal point and centre for the Lower River Tana and Delta area.

### 18.3.1 Definition

Based on the ideas discussed above, the full range of economic activities listed in the expanded ISIC

(International Standard Industrial Classification) (419 classes in total) has been examined and those sectors and activities that are thought to have potential for development are identified in **Tables 18.1** and **18.2**. All divisions are represented by at least one class of activity. Those areas of economic activity which have not been emphasised include manufacturing of paper, chemicals, metal and non-metallic products. These components are omitted because if they are to be developed in the region then the most logical location would be close to the Lamu Port within the planned area for heavy industrial activities.

### 18.3.2 Selection of Economic Classes for Inclusion in Scenario B

Having identified 258 classes of economic activities that could be promoted within the Plan area in the period up to 2050 a number of representative examples of the most likely forms of development have been selected in **Table 18.2**.

**Table 18.2 Potential Development within the Tana Delta up to 2050**

<b>Section A Agriculture, Forestry and Fishing</b>
Growing of rice
Growing of vegetables and melons, roots and tubers
Growing of sugar cane
Growing of tropical and subtropical fruits
Growing of citrus fruits
Raising of cattle and buffaloes
Raising of sheep and goats
Mixed farming
Gathering of non-wood forest products
Fishing
Aquaculture
Marine aquaculture
Freshwater aquaculture
<b>Section B Mining and quarrying</b>
Extraction of crude petroleum
Extraction of natural gas
Extraction of salt
<b>Section C Manufacturing</b>
Processing and preserving of meat
Processing and preserving of fish, crustaceans and molluscs
Processing and preserving of fruit and vegetables
Manufacture of vegetable and animal oils and fats
Manufacture of dairy products
Manufacture of soft drinks; production of mineral waters and other bottled waters
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
Manufacture of pharmaceuticals, medicinal chemical and botanical products
<b>Section D Electricity, gas, steam and air conditioning supply</b>
This section is added to cover construction and installation of solar panel systems
<b>Section F Construction</b>
Construction of roads and railways
<b>Section G Wholesale and retail trade; repair of motor vehicles and motorcycles</b>
Wholesale of agricultural raw materials and live animals
Wholesale of food, beverages and tobacco
Retail sale in non-specialized stores with food, beverages or tobacco predominating
Retail sale via stalls and markets
Retail sale via stalls and markets of food, beverages and tobacco products
Retail sale via stalls and markets of textiles, clothing and footwear
Retail sale via stalls and markets of other goods
Retail trade not in stores, stalls or markets

<b>Section H Transportation and storage</b>
Other passenger land transport
Inland water transport
Inland passenger water transport
Inland freight water transport
Service activities incidental to land transportation
Service activities incidental to water transportation
<b>Section I Accommodation and food service activities</b>
Short term accommodation activities
Camping grounds, recreational vehicle parks and trailer parks
<b>Section M Professional, scientific and technical activities</b>
Research and experimental development on natural sciences and engineering

## 18.4 Livestock

### 18.4.1 Intensive Cattle Ranching

#### 18.4.1.1 Area/Extent

An assessment of livestock rearing potential has already been made under Scenario A. For a commercial scale of operation to be undertaken reference has been made to the business case developed for the OI Pejeta Conservancy Ranch in Isiolo as part of the investment strategy for the LAPSET corridor (Monitor Group/Ministry of Agriculture, 2012).

This Land Use Plan recognises the great potential to improve quality, transport and marketing of cattle reared in the arid rangelands of North Eastern Kenya by purchasing 2-3 cattle each year from up to 5,200 pastoralist households, then fattening 8,000 animals for up to six months (an annual throughput of 16,000) in a specially purchased holding ground, covering 60,000 acres before slaughtering them in a purpose built abattoir and cold store, then transporting dressed cold carcasses to Nairobi. The investment case study provides clear evidence that growth in demand would justify this approach.

An equivalent scheme in the Tana Delta assumes that a large number of cattle currently raised within the Delta or driven from neighbouring arid rangelands will be fattened on high quality grassland before being sold and slaughtered through a new abattoir at Garsen, from which point cold dressed carcasses will be transported in refrigerated trucks to Mombasa and Nairobi. The holding area would require the setting aside of an equivalent area of 25,000 ha on wet grassland in the upper or lower Delta. In the case of the OI Pejeta Conservancy most of the investment capital (\$5.4 million) is required to purchase the 60,000 acres of land with the balance needed to build new abattoir and cold storage facilities. OI Pejeta is a not-for-profit community organisation

which reinvests all profits in the local communities. In the Tana Delta, much of the land is either community trust land, existing ranch land or claimed by government agencies and private owners. The basic components of this enterprise are shown in **Table 18.3**.

#### 18.4.1.2 Water Demand

The OI Pejeta conservancy and planned holding ground are located in an area with 700mm rainfall a year which is almost double that of the middle and upper Tana Delta. In order to cover the risk of drought, fodder crops are grown and a hay crop is taken to give four months' food reserves. By comparison potential holding areas in the wet grassland on the floodplain would only be suitable for six months of the year due to flooding, so additional land would be required on the terraces outside the floodplain for holding animals during the rains. Eight thousand cattle would require 20 litres/head per day equating to 60 m<sup>3</sup>/day during the dry season.

#### 18.4.1.3 Employment and Livelihoods

It is assumed that one herdsman would be employed for every 200 head of cattle, representing 40 permanent jobs in cattle management. Additional staff will be required to purchase cattle, to provide veterinary services, to operate the abattoir and to organise marketing. A provisional figure of 100 employees is assumed.

#### 18.4.1.4 Economic Value

A scheme designed to acquire 3 cattle per pastoralist household per year would represent in excess of 15% of each households' potential income from cattle sales for a total of 5,300 households.

Annual turnover based on value per head (live weight) of KSh 12,000 would amount to KSh 190 million. Assuming the 30% increase in cattle prices could be secured as is the case at OI Pejeta, the gross turnover in live cattle would be in the region of Ksh 250 million. However this



represents only the live weight component and excludes the value-added component of preparing cold-dressed carcasses for market. Gross revenue in the case of Ol Pejeta is in the region of KSh 64,000 / carcass, which gives a value of around KSh 1 billion/annum.

#### 18.4.2 Open Grazing

The current practices, whereby cattle are allowed to wander across much of the Delta in search of grazing would have to be curtailed under Scenario B due to the other developments that are under consideration. If any large commercial or industrial crop like sugar were to be established this would require a minimum of 10,000 hectares for a viable operation with the more likely target being 20,000 hectares.

**Table 18.4** shows what the net result would be of withdrawing grazing land for other uses. If all the uses listed were to be carried forward, (which is, in fact, highly unlikely due to other factors, including water demand) the overall grazing area would be reduced to around 33,000 hectares. Most of this land would be of marginal quality and only capable of supporting one animal on three hectares. Consequently, the free range herd would consist of a maximum of 11,000 cattle, compared with the 220,000 animals that are currently found in the Delta. The combination of ranched and open grazed cattle would maintain a permanent herd in the Delta of 27,000 animals.

**Table 18.3 Development of Commercial Cattle Ranching on 25,000 Hectares**

Project/Scheme	2013-2030	2031-2050
Area (Ha)	25,000	25,000
Annual throughput of cattle	16,000	16,000
Water Demand	60m <sup>3</sup> /day for 180 days	60m <sup>3</sup> /day for 180 days
Employment/Livelihoods	100	100
Capital Investment	USD 5.4 million	USD 5.4 million
Annual turnover – finished meat product	KSh 1 billion USD 12 million	KSh 1 billion USD 12 million

**Table 18.4 Assumptions Relating to the Withdrawal of Grazing Land**

Withdrawal of Open grazing land for agricultural use	Hectares
Nominal area for open grazing in 2010	112800
Area removed for controlled ranching	25000
Area removed for sugar cane cultivation	20000
Area removed for commercial plant	500
Area required for expansion of subsistence farming	12736
Area required for other commercial crops	21500
Total area withdrawn from open grazing	79736
Area remaining for open grazing in 2050	33064

## 18.5 Agriculture

This component of economic activity has the largest number of potential classes of development, which is hardly surprising given the rural status of the Tana Delta, and its recent history in terms of specific development proposals. The soils within the Delta are of variable quality. Those on the terraces are generally thin and infertile and lose moisture content during the dry seasons whereas those in the floodplain often consist of heavy clays that are difficult to plough and are waterlogged. At the same time, however, there are extensive pockets of good fertile soils enriched by silt brought down historically in annual floods.

The Tana Delta has high temperatures and humidity which make it ideal for growing a range of food and industrial crops, including sugar cane, rice, maize, cotton, tobacco and sisal, providing the areas of cultivation can be adequately protected from drought and flood. It is possible to grow two, three and even four crops a year in some areas with very fertile soils and plenty of water.

These crops can be grown by individual farmers for local consumption but there is keen interest from commercial undertakers to develop large farming areas for industrial scale production. **Table 18.5** shows some of the main classes of crop identified from the ISIC which could be considered in the Tana Delta.

For most of the examples examined in this scenario the information has been assembled from a variety of sources but there is one detailed business case which has been developed by the Monitor Group on behalf of

**Table 18.5 Main Classes of Crops Suitable for Growing in the Tana Delta**

Growing of rice
Growing of vegetables and melons, roots and tubers
Growing of sugar cane
Growing of tropical and subtropical fruits
Growing of citrus
Growing of sunflower

the Ministry of Agriculture, specifically related to fruit (Mango) growing in the Lowe Tana River as part of the LAPSSET corridor assessments. A summary is provided in **Box 18.1**.

### 18.5.1 Commercial Farming

#### 18.5.1.1. Area and Extent

In this analysis reference is made only to commercial scale production. Rice production requires the creation of level paddy fields that can be inundated prior to planting and then allowed to dry out as the crop matures. The existing area farmed by TARDA provides a typical example of a commercial holding of 2,400 Acres (1,000 Ha).

The most demanding use in terms of land area is sugar cane because a minimum area of 10,000 Ha has to be planted in order to justify the costs of building a sugar mill and associated power station, bagasse and ethanol processor together with vehicle park, stores and a wide range of ancillary buildings. Once the core area of the estate has been established, additional land may be added in order to improve economies of scale. Different

### BOX 18.1 Mango Production – Business Case for the Lower River Tana

Mangos are one of the fastest expanding fruit crops in Kenya, with annual production increasing by more than 25 % a year since 2005. 98% of production is consumed on the domestic market. The Government is seeking investors to develop a Mango fruit farming enterprise, focusing on the Middle East market and located on the River Tana within the Tana Delta. Kenya has one of the highest yields from mangoes in the world (in excess of 16 tonnes per hectare) with year –round production due to its favourable climate. The Ngowe variety, which has a particularly high sugar content and good flavour can yield 38 tonnes per hectare in the Delta.

The government's concept and business Plan is based on creation of seven nucleus farms, each of 50 hectares in size located at intervals along the River Tana and positioned so that they can purchase from contracted small-holder farmers with 20 kms radius of each farm. Proposed locations include two in Garissa, one at Hola, three in Garsen and one in Kikpini.

Details are available from:  
Kenya Ministry of Agriculture  
Kenya LAPSSET Corridor Mango Production Investment Opportunity; May 2012

tenure systems exist although the most efficient have proved to be estates managed directly by the operator, as in the case of Illovo Sugar, Malawi (Illovo, 2010). Additional areas may be farmed by small holders (outgrowers). Previous proposals to establish sugar cane plantations in the Tana Delta have been based on a gross area of 20,000-25,000 ha. In the model adopted for the purposes of Scenario B an Estate of 15,000 Ha is assumed with an additional area of 5000 ha operated by outgrowers.

Vegetable, tropical fruit and citrus farming can be established on a much smaller scale than sugar cane Plantations with viable commercial farms occupying less than 500 Hectares, (for example the proposed Mango project with 7 farms each of 50 Ha, See **Box 18.1**).

Sunflower seed production has been included as a potential crop because it can serve both food markets as a source of vegetable oil and industrial end uses. Production can take place at a wide variety of scales from market gardens to full commercial farms.

#### 18.5.1.2 Water Demand

The amount of water consumed by rice varies significantly with variety, location and climatic conditions. Some rice strains are adapted to growing in dry soils after initial establishment in water. Others are adapted to flood conditions and can continue to grow even when the paddy field is inundated with up to 900 mm of water during the ripening season. For Scenario B the assumption is made that water demand will be in the range from 450-700 mm over a growing season of 150 days. based on FAO figures ( FAO, 2004). Vegetables and melons are assumed to require 400-600 mm of water over a period of 120-150 days (FAO, 2004). Sunflowers have similar requirements. Tropical and Citrus fruits require 900-1200 mm over a continuous growing season of a year (FAO, 2004). Sugar cane also has a high water demand of 1500-2500 mm over a year (FAO, 2004). In each case the upper figure of the range has been adopted to reflect high evapo-transpiration rates in the Delta. Water demand has been calculated in **Tables 18.6** and **18.7** for the mix of crops and areas identified in the following sections, as summarised in **Table 18.12**.

**Table 18.6 Calculation of Water Demand for Commercial Crops under Scenario B in 2030**

Crop type	E-T Water uptake (mm)	Demand m <sup>3</sup> per hectare	Area (Ha)	Total M <sup>3</sup> /area	Growing Season (days)	Consumption (m <sup>3</sup> /day)	m <sup>3</sup> /sec
Rice	700	7,000	5,000	35,000,000	150	233,333	2.70
Intensive Vegetables	600	6,000	500	3,000,000	150	20,000	0.23
Extensive Vegetables	600	6,000	5,000	30,000,000	150	200,000	2.31
Fruit farming	1,200	12,000	250	3,000,000	365	8,219	0.10
Sugar cane plantation	2,500	25,000	10,000	250,000,000	365	684,932	7.93
<b>Totals</b>			<b>20,750</b>	<b>321,000,000</b>		<b>1,146,484</b>	<b>13.3</b>

**Table18.7 Calculation of Water Demand for Commercial Crops under Scenario B in 2050**

Crop type	E-T Water uptake (mm)	Demand m <sup>3</sup> per hectare	Area (Ha)	Total M <sup>3</sup> /area	Growing Season (days)	Consumption (m <sup>3</sup> /day)	m <sup>3</sup> /sec
Rice	700	7,000	10,000	70,000,000	150	466,667	5.40
Intensive Vegetables	600	6,000	1,000	6,000,000	150	40,000	0.46
Extensive Vegetables	600	6,000	10,000	60,000,000	150	400,000	4.63
Fruit farming	1,200	12,000	500	6,000,000	365	16,438	0.19
Sugar cane plantation	2,500	25,000	20,000	500,000,000	365	1,369,863	15.85
<b>Totals</b>			<b>41,500</b>	<b>642,000,000</b>		<b>2,292,968</b>	<b>26.5</b>

### 18.5.1.3 Employment and Livelihoods

Levels of employment vary seasonally in commercial farming. The most labour intensive periods are in planting and harvesting, although weeding and maintenance during the establishment of the crop can also demand high inputs. Commercial undertakers will usually seek to keep the permanent labour force as small as possible to minimise cost and then hire contractors or casual labourers for specific tasks.

Rice and sugar cane both require large pools of temporary workers. Labour inputs are very high when rice is grown by individual farmers. (In Indonesia the average rice farmer supports a family on a holding of only 0.1-0.5 ha). With large paddy fields ploughing and combining can reduce labour requirements dramatically. In the USA rice farms of 250 acres (104 ha) require only 1 full time employee to operate the entire holding. It has been assumed in this report that 100 FTE are created for every 1,000 ha of rice paddy. Sunflower production is mechanised, except for smallholder farming and requires very low labour inputs similar to those for rice in the USA.

In the case of sugar production, areas of cultivation are usually large enough to maintain a rotation in planting, cultivation and harvesting so that more or less permanent employment is required. Levels of efficiency vary widely from country to country. In South Africa, the direct labour force equates to one full time job equivalent (FTE) per 5 hectares, but the indirect employment including seasonal workers is 4.4 times greater bringing the total employment to around 1 FTE per hectare. This equates to 10,000 workers on a 10,000 hectare sugar estate. Comparable figures are not available for Kenya because most sugar is grown under outgrower schemes which are more labour intensive. In Scenario B it is assumed that an area of 15,000 ha of sugar cane plantation would require a labour force of 15,000 workers (both direct and indirect labour).

Commercial vegetable farming requires relatively high labour inputs and a model from Botswana has been adopted for the Scenario with 4 FTEs per hectare. 2,000 employees would be required for a 500 ha farm. Commercial fruit growing also relies on a small permanent labour force of around 10-20 FTEs for 500 ha with a substantial seasonal increase in casual labour for pruning, picking and packing the annual crop. The model presented for mango growing in the Tana Delta assumes core commercial farming areas supported by out grower farmers and assumes 1,750 FTEs within the main company on 350 ha (5 FTEs/Ha) with 6,000 independent growers.

### 18.5.1.4 Economic Value

The economic justification for each type of farming enterprise would need to be considered on a case by case basis. In general, rain fed smaller scale operations under 1,000 have much lower capital investment costs than those involving large areas 5,000Ha+ or extensive irrigation. Estimates for annual turnover provide a simpler form of comparison and have been used in this instance. Production yields and prices are taken from FAOSTATS if the source has not been directly quoted in the text above.

In the case of both vegetable and fruit farms, a wide variety of crops could be grown in the Tana Delta and a random mix has been chosen to arrive at an 'average' for illustrative purposes as presented in **Tables 18.5, 18.6 and 18.7**.

A distinction is made between vegetable crops which have very high labour inputs due to the need for staking and correspondingly high value per kilogramme (e.g tomato and peppers) as shown in **Table 18.8** and other field crops which are suitable for extensive mechanised cultivation (**Table 18.9**) but have relatively low values per kilogramme.

A wide variety of fruits can be grown in the Tana Delta including mangoes, lemons, oranges, limes, pawpaws, passion fruit and bananas among others. **Table 18.10** shows current yields and market prices (Mombasa December 2013) for a selected group.

Clearly a variety of different projects could be considered under each type of enterprise (with the exception of sugar where the amount of land for a single project, needs to be in excess of 100 km<sup>2</sup> to cover the investment in processing plant). For modelling and comparative purposes it has been assumed that, with the exception of intensive vegetable farming, 5,000 Ha would be allocated for each of the main types of farming enterprise in the period 2010-2030 and a further 5,000 Ha in the remaining 20 years, bringing the total to 10,000 Ha for each crop type by 2050.

In the case of intensive vegetables, the scope for development will be confined by market opportunity and it would be unrealistic to assume that the same area could be developed in the chosen time horizons. Instead, the areas involved are reduced to 500 hectares by 2030 and 1,000 hectares by 2050. A similar approach has been adopted for fruit farming.

**Table 18.8 Indicative Production and Value of Intensively Grown Vegetable Crops per Hectare**

Crop Type	Yield Tonnes / Hectare	Price /Kg	Value KSh million /Hectare
Tomato	60	54	3.24
Sweet Peppers	25	170	4.25
Average	42.5	112	3.7

**Table 18.9 Indicative Production and Value for Extensively Grown Crops per Hectare**

Crop Type	Yield Tonnes / Hectare	Price /Kg	Value KSh million /Hectare
Green Grams	1.3	100	0.13
CowPeas	3	57	0.17
Sunflower	5	25	0.13
Average	3.1	61	0.14

**Table 18.10 Indicative Production and Value for Fruit Crops per Hectare**

Crop Type	Yield Tonnes / Hectare	Price /Kg	Value
Mango	38	18	0.68
Oranges	15	32	0.48
Banana	20	32	0.64
Lemon	10	36	0.36
Lime	8.7	28	0.24
Average	18.34	29.2	0.48

**Table 18.11 Comparative Outputs of Sugar based on 65 tonnes/ha and 100 tonnes/ha Sugarcane**

Crop Type	Yield Tonnes / Hectare	Price /Kg	Value KSh million /Hectare
Sugar Cane	65		
Raw Sugar	6.5	97.43	0.63
Crop Type	Yield Tonnes / Hectare	Price /Kg	Value KSh million /Hectare
Sugar Cane	100		
Raw Sugar	10	97.43	0.97



The potential for sugar production depends upon achieving a critical mass in terms of sugar cane production to justify investment in excess of 400 million USD (Johnson and Seebaluk, 2012). Projections of the returns on investment would depend on the yields established. In theory, production in the coastal region should allow higher yields to be achieved than in Western Kenya because of the higher temperatures and faster maturing varieties that could be grown. However, Kenya's performance in sugar production has consistently fallen below expectations and in recent years output of cane per hectare has been in the region of 65 tonnes compared with its potential of 100 tonnes (Johnson and Seebaluk, 2012). The difference in output is shown below in **Table 18.11**.

Both of these figures have been incorporated in **Table 18.12** to allow comparisons to be made with other agricultural projects.

### 18.5.2 Subsistence Farming

Under Scenario B it is assumed that the existing population (and natural increase) would be supported by maintaining the existing pattern of subsistence farming. The conditions necessary to achieve this end state have already been examined as part of Scenario A and are repeated below.

#### 18.5.2.1 Area and Extent

As described in the existing situation, the land currently set aside in the Delta for mixed subsistence farming under individual households' control is 6,204 hectares.

Population increase will require that the permanently cultivated area is increased by 70% (to 10,460 hectares) by 2030 and treble in size by 2050 (to a total of 18,930 hectares). The increase in permanent cultivation will serve only to maintain a ratio of 1.5 acres per household. It would not tackle the continuing problems of food shortages for more than 20% of the population. Realistically, the area in permanent cultivation would need to be doubled (i.e. 3 acres/1. Ha) per household to achieve self-sufficiency in food.

#### 18.5.2.2 Water Demand

The assumption under this scenario is that subsistence agriculture would continue to rely on annual rains and periodic flooding to saturate soils and provide sufficient soil moisture to allow vegetable crops and maize to be produced. There would be no net uptake of water from the river system during the dry seasons

#### 18.5.2.3 Employment and Livelihoods

It is assumed that the land farmed by each household requires 1 FTE supported by other family members on a part-time basis amounting to a total of 2 FTE for each holding.

#### 18.5.2.4 Economic Value

The value of food produced is based on the assessment under the existing situation that a farming household generates produce to the equivalent value of KSh 18,400 per year (Odhengo *et al*, 2013). The value of food produced for subsistence has been estimated using the formula applied in paragraph 16.5.4.

Assessment Criteria	Year		
	2010	2030	2050
All Households in Delta	19,885	33,550	60,595
Farming HH in the Delta	9,943	16,775	30,298
Nominal value of food produced KSh Million	183	309	557

**Table 18.12 Potential Commercial Agricultural Enterprises in the Delta including in Scenario B1**

Project / Scheme	2013 - 2030	2031 - 2050
<b>Rice Farms</b>		
Area (Ha)	5000	10000
Water Demand (million m <sup>3</sup> )	35	70
Employment	500	1000
Production (Tonnes)	25,000	70,000
Gross Turnover (Million USD)	12.5	35
<b>Intensive Vegetable Farms</b>		
Area (Ha)	500	1000
Water Demand (million m <sup>3</sup> )	2.5	5
Employment	500	1000
Production (Tonnes)	21,250	42,500
Gross Turnover (Million USD)	22	44
<b>Extensive Vegetable Farms</b>		
Area (Ha)	5,000	10,000
Water Demand (million m <sup>3</sup> )	25	50
Employment	500	1000
Production (Tonnes)	15,500	31,000
Gross Turnover (Million USD)	8.3	16.6
<b>Sugar Cane Plantation</b>		
Area (Ha)	10,000	20,000
Water Demand (million m <sup>3</sup> )	685	1370
Employment	10000	20,000
Production Cane 65 Tonnes/Ha	650,000	1,300,000
Gross Turnover (Million USD)	75	150
Production Cane 100 Tonnes/Ha	1,000,000	2,000,000
Gross Turnover (Million USD)	116	231
<b>Fruit Farms</b>		
Area (Ha)	250	500
Water Demand (million m <sup>3</sup> )	3	6
Employment	2000	4000
Production (Tonnes)	4,585	9,170
Gross Turnover (Million USD)	1.4	2.8

**Table 18.13 Land Areas and Employment in Subsistence Farming in 2010, Extrapolated to 2030 and 2050**

Description/Year	2010	2030	2050
Population	102000	174,000	315000
All Households (5.2 occupants)	19885	33,462	60,577
Number of Farming Households	9927	16,731	30,288
Land Area (Ha) at 1.5 acres/HH	6,204	10,457	18,930
FTE Jobs/Livelihoods	12,409	20,913	37,861
Value of agricultural production KSh million (at 2001 prices)	62	105	189
Land Area (Ha) at 3 acres/HH	6,204	50,192	90,865
FTE Jobs/Livelihoods	12,409	41,827	75,721
Value of agricultural production KSh million (at 2001 prices)	62	209	379

Based on 1.5 acres/HH

Based on 3 acres/HH

Table 18.13 shows the areas assumed to be under subsistence cultivation in 2010, and the increase in permanent cultivation required to maintain 1.5 acres/household and to increase this to 3 acres/household. The table also shows the number of related FTE jobs created in 2030 and 2050 (based on 2 FTEs /1.5 acres and 4 FTEs/3 acres).

## 18.6 Fishing

### 18.6.1 Area and Extent

Two types of commercial development need to be considered, that relating to freshwater fisheries (aquaculture) and that based on marine fisheries (either mariculture or wild stock harvesting). The potential of wild freshwater fisheries, catching stock from rivers and lakes, has been largely exploited by the local communities and particularly the Luo using artisanal methods. Any new enterprise would need to be based on the establishment of holding ponds in locations which could be supplied with sufficient clean water without running the risk of being inundated in periods of flooding. There are many examples of successful fish farming ventures in Africa. One, falling within the Deltas Programme for Kenya, is the establishment of Dominion Farms in Yala Swamp. This is a large scale enterprise with substantial international funding from the Africa Enterprise Challenge Fund AECF (Shitote *et al*, 2011). The parent company, under contract to the Kenyan Government, is producing 2 million fingerlings for sale to fish farmers throughout Kenya. It has also established a 25million dollar fish breeding programme and a fish

food factory using soya flour as the raw foodstuff. The business Plan involves recruiting up to 6,000 farmers who are given assistance to dig ponds and are trained to become fish farmers. Individuals are provided with loans underwritten by the government and banks and Dominion Farms as the operating company buys the fish for blast freezing and export to world markets (Shitote *et al*, 2011). It is claimed that an individual farmer can earn around KSh 80,000 a year. Fish ponds typically cover up to 60 acres.

### BOX 18.2 Case Study – Dominion Farms – Yala Swamp

AECF repayable grant US\$ 979,229  
 Matching funds from Dominion US\$ 1.7m  
 Amount spent US\$ 38m on infrastructure, diverting the river, building roads,  
 Produce Commercial fishing yet to start. 2m fingerlings are produced per month  
 Number of smallholder farmers benefiting: Tens of thousands of small holder farmers receiving fingerlings.  
 US\$1.5m into local economy through wages.  
 Up to 6,000 contract farmers when fully operational, each with potential to earn US\$ 1,750 p.a.

The Yala example is quoted as a potential business case because it is located in a similar delta and has been taken to the first level of development. However, it must be noted that the scheme has also been heavily criticised as a 'land-grabbing' process in which the interests of the external investor have overridden genuine local concerns and resulted in an export-based operation for international markets with very little food generation for Kenyans.

In order to avoid similar issues in the Tana Delta, where land grabbing schemes have caused serious unrest in the past, it is proposed that fish farming should be seen as, essentially, a local community programme. An ambitious programme is proposed for every community (80) within the Tana Delta to have one fish farm by 2030 and two by 2050. Each farm would consist of five ponds of average size 500 m<sup>2</sup> and average depth of 1 metre. Fish farming operations would be run as an integrated land use with agriculture and would rely on the use of animal manure to provide enriched organic nutrients to support other fish foods.

### 18.6.2 Water Demand

Establishment of successful fish ponds requires either a through flow of water or the use of pumps to aerate the water and provide enough oxygen for fish to thrive. In the context of the Tana Delta it should be possible to find plenty of locations where water can be transferred by pipe to adjacent fish ponds directly from the river network.

### 18.6.3 Employment and Livelihoods

The level of employment in fish farming is variable. A large labour force is required to hand-dig and maintain fish ponds, especially during and after the rains in areas prone to natural flooding. Temporary workers are also required to drag nets through ponds to remove mature fish at harvest time. However, once the ponds have been created and stocked it is possible for only a few workers to transport and distribute pelleted fish food and maintain security. These tasks can often be accommodated alongside routine farming operations in the same area. Cleaning and marketing fish if they are not consumed locally is also labour intensive.

It is assumed that every pond would be maintained by one permanent worker with ten part time assistants allocated within each settlement to assist with harvesting, maintenance and repair. On this basis 106 full time jobs would be created with a further one full time equivalent position (shared by ten assistants) for each community making 212 jobs in total.

## 18.6.4 Economic Value

### 18.6.4.1 Capture Fisheries

Freshwater and marine capture fisheries and their related contribution to the economy are assumed to continue under Scenario B at the same levels projected for Scenario A, [i.e. as shown in **Table 18.14** (reproduced from 17.17)].

### 18.6.4.2 Aquaculture

In Africa, an integrated fish farm system using 500m<sup>2</sup> ponds can produce 5.5 tonnes of fish per hectare per year (Ogello *et al*, 2013). On this basis each community would be able to harvest around 12 tonnes a year at an average price of Ksh 35/Kg, yielding KSh 420,000 per settlement and KSh 44.5 million for the Delta as a whole by 2030. These figures would double to 2050 (See **Table 18.15**).

## 18.7 Bee Keeping

### 18.7.1 Area and Extent

The same assumptions on the expansion of bee keeping have been adopted for scenario B as were applied in Scenario A. There is considerable potential to expand areas of forage for bees and to increase the number of hives in each community and this Scenario assumes that the current scale of production of honey is doubled by 2030 and trebled by 2050 (See **Table 18.16**). However, the capacity to increase production will be governed in practice by the condition of forests, woodlands and other areas with extensive acacia and other flowering tree species. If these areas are cleared to make way for other land uses, these yields could not be sustained.

### 18.7.2 Water Demand

Bees require access to water at all times of the year but the quantities are not significant at a delta wide scale.

**Table 18.14 Freshwater and Marine Fisheries in 2010, Extrapolated to 2030 and 2050**

Description of fishing activity	2010		2030		2050	
	Yield (kg)	Value KSh Million	Yield (kg)	Value KSh Million	Yield	Value KSh Million
Fresh water	394,000	34278000	500,000	43500000	750000	65250000
Marine	220,000	220,087	250,000	21750000	275000	23925000
Totals	614,000	34,498,087	750,000	65,250,000	1,025,000	89,175,000

**Table 18.15 Fish Farm Developments in the Delta to 2030 and 2050**

Element	2030	2050
Number of Fish ponds	530	1060
Total surface area (Hectares)	26.5	53
Number of fish stocked as fingerlings /year	180,200	360,400
Yield / Tonnes / Hectare	5.5	5.5
Total weight harvested (Tonnes/annum)	1,272	2,544
Value of fish harvested (KSh million)	44.5	89

**Table 18.16 Projections of Honey Production from 2010 to 2030 and 2050**

Year	2010	2030	2050
No of Hives	12,150	24,000	36,000
000 Kgs	68-96	240	360
KSh Million	20-29	72	180

**18.7.3 Employment and Livelihoods**

The number of full time jobs that could be created in beekeeping is estimated at 140 in 2010, 480 in 2030 and 720 in 2050. Based on part time beekeeping to supplement other forms of income, with an average yield of 50 kg per beekeeper the numbers would be 1,460, 4,800 and 7,200 respectively.

**18.7.4 Economic Value**

The value of annual production is shown in Table 18.16.

**18.8 Using Natural Resources****18.8.1 Non Timber Forest Products***18.8.1.1 Area and Extent*

It is clear from the analysis in **Scenario A** that the continuing exploitation of natural resources to meet the pro-rata demands of increasing population could not be sustained beyond the carrying capacity and natural regeneration of available woodland, scrub and thicket. Evidence from Scenario A shows that the sustainable threshold has already been reached and by 2030 there would be no prospect of supplying any additional volume of building materials/charcoal and fuelwood without destroying the basic resource.

*18.8.1.2 Water Demand*

Water demand would become the second limiting factor (after loss of habitat), which would severely curtail opportunities for harvesting natural resources in the Tana Delta, due to the expanding areas of farmland and irrigation considered under Scenario B. A possible reduction of up to one third in the River Tana's flow could seriously affect riverine forests, grassland and other freshwater habitats.

*18.8.1.3 Employment and Livelihoods*

It is assumed that employment and livelihood activities would continue to grow until 2030, but thereafter the numbers would become static or might actually decline. In 2010 it has been assumed that around 4,971 individuals obtained a full time living from harvesting NTFP. This number would rise to 8,365 by 2030 but then remain static or decline.

*18.8.1.4 Economic Value*

The value of NTFP in 2030 has been estimated at KSh 134 million in 2030 and would then remain static or fall.

**18.8.2 Housing***18.8.2.1 Area and Extent*

It has been assumed that the expansion of natural resource use would continue until 2030 in the manner described for Scenario A but that for the next twenty years development of alternatives, including use of brick, concrete, zinc roofing, kerosene or solar power for cooking, lighting and other energy requirements would have to meet subsequent expansion (See Table 18.17). This essential change would create new opportunities for business development and employment but at higher cost.

*18.8.2.2 Water Demand*

The search for house building materials would be affected by increased competition for water in the same way as NTFPs, due to increasing stress on the source areas (reed marsh, forest palms, mangrove poles, etc.).

*18.8.2.3 Employment and Livelihoods*

In 2010 it is estimated that housing construction and repair provided the equivalent of around 1,265 full time



**Table 18.17 Use of Natural Resources for Building Construction in 2010 and 2030**

Category	2010	2030	2050
Total number of households	19,885	33,550	60,595
Number of Households (in Pokomo & Orma Communities)	9,943	16,775	30,298
Pokomo (New and rebuild) KSh million	66	111	201
Orma (New and rebuild) KSh million	34	57	104
Value of housing construction and repair (KSh million)	100	169	305

**Table 18.18 Details of Charcoal and Firewood Production under Scenario B**

Year	2010	2030
Population	102000	174,000
All Households (5.2 occupants)	19885	33,462
25% of Households engaged	4,971	8,365
<b>Charcoal</b>		
Thousand Tonnes	37-57	64-100
Woodland (000 Hectares)	44-68	77-120
Value (KSh Million)	130-200	270-420
<b>Firewood</b>		
Thousand Tonnes	9.2-14.2	16-25
Woodland (000 Hectares)	11-17	19-30
Value (KSh Million)	23-36	40-63
<b>Charcoal &amp; Fuel Wood Combined</b>		
Thousand Tonnes	46.2-71.2	80-125
Woodland (000 Hectares)	55-85	96-150
Value (KSh Million)	153-236	310-483

jobs or livelihoods in the two main communities. Based on the increase in population and household formations anticipated, this number would rise to 2,134 by 2030 and 3,854 by 2050 assuming that traditional house-building methods continued to be used throughout the Plan period. In practice, as has already been stated, there would need to be a major switch to alternative materials beyond 2030.

#### 18.8.2.4 Economic Value

The estimated value of natural materials used in housing construction would rise from 100 million in 2010 to KSh 169 million in 2030 and KSh 305 million in 2050 as shown in **Table 18.17**.

### 18.8.3 Charcoal and Firewood

All natural resources depend on the same critical habitats and these areas would diminish in size over the Plan period under **Scenario B**.

#### 18.8.3.1 Area and Extent

The current area which is used for harvesting wood for firewood and charcoal is estimated to be 55-85 (say 70) Km<sup>2</sup>. (See **Table 18.18**) This would need to rise to 123 Km<sup>2</sup> by 2030 and 223 Km<sup>2</sup> by 2050 to keep pace with population growth. These growth rates are not sustainable for the reasons already given above and it has been assumed that the maximum outputs would be achieved before 2030, with no prospect of further growth beyond this time.

#### 18.8.3.2 Water Demand

A significant proportion of firewood and charcoal is obtained from forests in the wetland zones of the Delta and these areas would be amongst the most seriously affected by conversion to other land uses and increased water abstraction under **Scenario B**.

### 18.8.3.3 Employment and Livelihoods

The number of theoretical full time livelihoods to be created would rise from 200 in 2010 to 400 in 2030 and 600 in 2050. However, exhaustion of the reserves would occur long before the upper limits could be reached and a realistic maximum would probably be 400.

### 18.8.3.4 Economic Value

Income generation based on the formula in **Scenario A** amounts to around KSh 195 million in 2010 and would rise to a maximum of KSh 397 million in 2030.

### 18.8.5 Alternatives to Natural Resource Use

Some natural resources are non-replaceable but others could be substituted, including building materials, charcoal and fuel wood. At this point in developing scenarios, it has not been practical to include a detailed analysis of the range of materials, their sourcing, water demand, equivalent employment generation characteristics and value. However, the following assumptions have been made in order to compensate for the restrictions on natural resource use beyond 2030 (See **Table 18.19**).

For construction, the minimum cost<sup>7</sup> of providing low cost social housing of comparable size to Pokomo dwellings is in the region of KSh180,000 per unit, while alternative fuel prices are roughly double the cost of charcoal. Solar heating and electricity generation offers major opportunities for improving living conditions in the Delta but at costs which cannot be considered at current income levels. A small solar photovoltaic system capable of lighting a house and powering one or two small appliances with a combined demand of 30-50 watts currently costs in the region of 300-500\$ (KSh 22-45,000). Costs have been falling steadily with increased demand and, in the timescale of the Plan, the scope for introducing rural electrification and independent solar systems will be very considerable. This topic is considered further under the section on industry.

## 18.9 Tourism

### 18.9.1 Area and Extent

According to the Tana District Development Plan (2008-2012) there are currently six hotels within the Delta. There are also a number of small establishments offering rooms with minimal facilities for overnight accommodation in Garsen and Witu. Cold and cooked food is sold by street traders and each town has a few small food outlets catering primarily for the local community. The catering, guesthouse and restaurant sector can be expected grow with rising levels of commercial activity in each of the main centres and it is reasonable to expect that a good quality hotel will be established in Garsen and Witu, and possibly Tarasaa.

The Tana Delta offers major opportunities for developing eco-tourism based on its biodiversity and status as a Ramsar site. Bird watching and cultural tours would have international appeal. The most significant areas for eco-tourism would include, the coastline, the river network especially in the lower reaches accessed from Kipini, Ozi Forest, other riverine forests and the Tana River Primate National Reserve. Two high quality tented and chalet camping sites could be accommodated, one within the lower Delta and the second in the Primate Reserve; each with 30-40 units providing 60-80 bed spaces.

### 18.9.2 Water Demand

Water consumption in catering and hotels can be significant but for the purposes of the Scenario assessment these activities are subsumed within the overall development of the urban areas.

### 18.9.3 Employment and Livelihoods

On the assumption that in the region of 200 livelihoods are supported at the present time by this sector, this number could double by 2030 to 400 and double again by 2,050 to 800 full time jobs.

**Table 18.19 Alternatives to Natural Resource Use in the period 2030-2050**

Product	No of Households	Value (Million KSh)
New Building Construction	27,115	4,880
Clean technology cooking stoves	27,115	22.8
Solar installations	27,115	1,220

<sup>7</sup>Houses built under slum clearance and emergency relief schemes by charities like Habitat.

#### 18.9.4 Economic Value

If it is assumed that three hotels are built with a total floor space of 36,000 m<sup>2</sup> and 6 quality restaurants covering 1,200m<sup>2</sup> the development cost at current prices would amount to around 2.23 billion KSh or 25.4million USD. Development of two campsites could cost in the region of 50 million KSh or 570,000 USD.

A very rough assessment of annual turnover has been made by assuming 60% occupancy (the industry standard for viable operations) with 120 bedspaces in tented accommodation and 300 bedspaces in hotels. Rates for tented and hotel accommodation have been assumed to be \$40 (KSh 3,360) and \$100 (KSh 8,500) respectively. The combined gross turnover amounts to KSh 640 million with an additional KSh 100 million for restaurant and catering enterprises.

### 18.10 Trade, Commerce and Financial Services

#### 18.10.1 Wholesale and Retail

Wholesale, retail and the repair sectors are heavily dependent on the overall state of local and national economies since the goods and services are required by all other activities, like farming, livestock rearing, mining, transport, construction etc.

##### 18.10.1.1 Area and Extent

The whole of the Delta Plan area would benefit from an expansion in trade and financial services, but with particular emphasis on the Lower Delta.

##### 18.10.1.2 Employment and Livelihoods

There would be significant growth in employment in these two sectors.

##### 18.10.1.3 Water Demand

Trade and finance would have only domestic scale demands for water and the figures are subsumed within general water consumption for the population as a whole.

##### 18.10.1.4 Economic Value

Estimates of the value of trade which were generated for the Existing Situation and Scenario A would not be relevant to the more commercial model of future growth represented by **Scenario B**, since each commercial activity would generate significant trade in its own right and this in turn would lead to indirect growth in trade (the multiplier effect). For this reason the value of trade is modelled on the same percentage of the national economy (10.8%). Similarly, the contribution made by the financial sector is assessed at 4.2%.

The value of trade is estimated at KSh 4,057 million in 2030 and KSh 8,647 million in 2050, while finance contributes KSh 1,578 million in 2030 and KSh 3,363 million in 2050.

### 18.11 Mining and Industry

#### 18.11.1. Oil and Gas Exploration and Development

##### 18.11.1.1. Area and Extent

Large areas are allocated to mineral prospectors as areas of search for minerals like oil and gas, and most of the Tana Delta is included within a prospecting licence area. Initial reconnaissance is undertaken using light aircraft (or vessels at sea) to carry out airborne remote sensing. If interesting anomalies are identified in the underlying rock structures, which suggest the presence of oil and/or gas reservoirs, the next stage of exploration involves drilling one or more pilot boreholes. In many cases the borehole may penetrate rocks with the necessary characteristics to support oil and gas but the wells will be dry. If the presence of hydrocarbons is confirmed the borehole may be capped to allow subsequent re-entry to evaluate the find. The existence of oil and/or gas in underground deposits does not mean that exploitation will automatically follow. Samples of the oil/gas are taken for analysis and very detailed studies are required to model the three-dimensional characteristics of the 'oil/gas field' in order to determine how much exploitable gas or oil is present and whether it is of a suitable nature to extract using current technology.

The search for oil and gas also extends out to sea, where geological conditions are thought to be similar to those off the Tanzanian and Mozambican coasts where large gas finds have been discovered in the last five years.

If, after exhaustive tests, a 'commercially viable' find is announced, the operating company will develop an extraction plan and programme, raise the necessary finance for developing the oil/gas field and apply for an extraction licence.

Both stages of exploration and development should involve a full environmental and social assessment as part of the technical studies.

The amount of land required to position an exploration drilling rig is less than one hectare, although access is required for heavy equipment by road. Large parts of the Tana Delta would be inaccessible to drilling equipment unless it could be transported by barge or helicopter. However, access roads could be used to reach a sufficient number of locations for the necessary trials to take place in the event of a potential oil/gas discovery.

If oil and or gas was found in exploitable quantities, the operating company would plan one or more permanent well sites from which the oil and/or gas could be extracted. This would entail drilling production wells and then connecting these to pipelines which would convey the crude hydrocarbon output to a site for onward shipment (by sea) or to a land-based processing Plant. The logical destination of any oil or gas found in the Tana Delta would be the proposed oil refinery to be built as part of the LAPSET project.

#### 18.11.1.2 Water Demand

In the exploration stage water is used as a medium to carry drilling mud to the base of any borehole as a lubricant, to reduce the temperature of the drill bit and to flush out rock particles and carry these back to the surface. Use of water needs to be carefully controlled to avoid environmental damage from the dispersal of wastes and drilling mud.

In the operating phase, water is sometimes used to pressurise an underground reservoir and effectively force oil and gas which is trapped in the rock into the well and back to the surface.

Only a small amount of water is used in the exploration phases whereas large quantities can be required to support production.

#### 18.11.1.3 Employment and Livelihoods

Most operations associated with oil and gas exploration and development are very technical and require highly skilled and experienced workers. In consequence, most jobs can only be filled by external experts. However, in the development phase, a large support team is needed including drivers, labourers, road builders, pipeline welders, engineers and mechanics. Fewer than fifty workers are required during exploration and perhaps 200-300 during the development phase, reducing to fewer than fifty again, once full production has commenced.

#### 18.11.1.4 Economic Value

The cost of sinking an individual borehole can easily exceed USD 50 million and development of a substantial oil/gas field may run into billions of dollars. Consequently, an oil and/or gas project would only proceed in the Tana Delta if the economic returns were similarly large. Experience elsewhere, including the new Turkana field in Kenya and the Albertine Rift finds in Uganda highlight the need to plan for significant benefits to flow to local communities in the affected areas as well as to the national exchequer and this will be a key concern for both County Governments if oil and gas is eventually found in the Tana Delta area.

**Table 18.20 Potential Oil and Gas Development in the Tana Delta**

Exploration Phase	Requirements
Area required for drilling	1-5 hectares
Water requirements	Low (under 1 million m <sup>3</sup> )
Employment / Livelihoods	10-50 workers
Value	USD 1 -20 million
Development Phase	
Area required for drilling, pipelines, storage yards, access	50-200 hectares
Water requirements	Unknown (potentially large)
Employment / Livelihoods	200-300 workers during construction. Under 50 workers during production
Value	Multi-million dollar investment

### 18.11.2 Heavy Mineral Sand Mining

#### 18.11.2.1 Area and Extent

The Tana Delta sand dunes have been identified as a promising location for finding commercially viable quantities of heavy mineral sands, comprising rutile, ilmenite and zircon (Government of Kenya, 2009). Similar deposits exist along the Somalian coastline and in Kwale County (the most southerly on the coast) (Government of Kenya, 2009). There are many serious reservations about working mineral sands in the Delta because of the damage that would result to the Ramsar site. Nevertheless the details of comparable operations are given here in order to allow an assessment of costs and benefits to be made.

A titanium mine has been opened in Kwale County with the first shipment of minerals taking place in 2013. The Kwale mine expects to produce 440,000 tonnes of ilmenite, rutile and zircon over a period of 13 years. The extracted concentrate is shipped from a purpose built coastal jetty taking large tankers to overseas refineries (principally in Australia). Over \$300 million in taxes and royalties will be generated for Kenya over the mine's life (Mining Weekly Sept, 2013). The deposit has been quoted as holding 3.1 billion tonnes of high grade (3%) heavy minerals.

Ore concentrations are usually closer to 1% of the total volume of sand that must be excavated, so a development exporting 400,000 tonnes of concentrate a year would involve mining in excess of 40 million tonnes of sand a year, equivalent to an area of 200 hectares from a sand dune with an average height of twenty metres.

Two methods of extraction are typically used. If the ore deposit is above the water table large earthmoving excavators and dump trucks or mobile conveyors are used to transfer the sand to a processing plant (Government of Kenya, 2009). Alternatively, if the deposit lies below

the water table a large lagoon is excavated in order to allow a massive floating dredger to be introduced. Sand is then dredged and pumped through pipelines to the processing plant (Government of Kenya, 2009).

Regardless of the method of extraction, the separation of heavy minerals from low grade 'worthless' sand is undertaken using centrifuges, filters, electrostatic or chemical means. The concentrated ore is dried and exported while sludge and slime residues are pumped to settling lagoons or released in open water. Bulk sand is usually returned to the site of excavation to allow rehabilitation to take place (Government of Kenya, 2009). All of these processes have varying degrees of adverse environmental impact.

#### 18.11.2.2 Water Demand

Large amounts of water are needed at all stages of extraction and processing. A particular challenge on the Kenyan coast is the potential for disruption of recharge, or saline contamination of existing sand dune aquifers.

#### 18.11.2.3 Employment and Livelihoods

Large scale extraction processes of this nature will typically require a labour force of 100-200 (Mining Weekly, 2013).

#### 18.11.2.4 Economic Value

The average value of the three main products is around \$400/ tonne, giving a gross turnover of USD 176 million a year (KSh 14.8 billion).

### 18.11.3 Industry and Manufacturing

A wide range of manufacturing activities could be considered within the Tana Delta over the next 40 years, but for the reasons discussed in the introduction it is likely that the industrial zone within Lamu Port would attract the majority of such facilities. Nevertheless Garsen and Witu could be developed as local centres with a particular emphasis on adding value to local

**Table 18.21 Indicative Heavy Minerals Sands Mining Operation**

Phase of Operation	Requirements
Area of land taken each year	200 hectares
Excavation of sand each year	40 million tonnes
Annual reinstatement	200 hectares / 39 million tonnes sand
Disposal of slimes / silt each year	1 million tonnes
Use of water	In excess of 40 million m <sup>3</sup>
Number of Employees	250
Annual Turnover	USD 176 million



products. Fish, meat, dairy and natural raw material processing could be developed as a specific 'cluster' activity and given a strong marketing identity under a collective Tana Delta brand name.

The range of activities listed in the ISIC is shown below.

### Section C Manufacturing

- Processing and preserving of meat
- Processing and preserving of fish, crustaceans and molluscs
- Processing and preserving of fruit and vegetables
- Manufacture of vegetable and animal oils and fats
- Manufacture of dairy products
- Manufacture of soft drinks; production of mineral waters and other bottled waters
- Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
- Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
- Manufacture of pharmaceuticals, medicinal chemical and botanical products

### 18.11.3.1 Area and Extent

Rather than consider each of a number of manufacturing processes in isolation, this scenario considers the possibility of establishing three industrial parks; with a main centre at Garsen and two subsidiary sites in Witu and Tarasaa. The Garsen Industrial Centre would occupy 60 hectares and those at Witu and Tarasaa 30 hectares each. It is assumed that 30% of each site would be developed as factories with the remaining 70% allocated to external storage, circulation and other infrastructure (electricity sub-station/transformer – water treatment plant etc.). On this basis the Garsen site would offer the potential of 180,000 m<sup>2</sup> (1.8million sq feet) of factory /warehousing space with a similar amount split evenly between Witu and Tarasaa (See **Table 18.22**).

Over the next fifteen years to 2030 it is assumed that half the total area of the available development sites might be taken up with three factories each occupying 20,000 m<sup>2</sup> and three occupying 40,000 m<sup>2</sup> each. The total area of developed floor space by 2030 would amount to 180,000m<sup>2</sup>. The remaining site areas would be developed between 2030 and 2050.

**Table 18.22 Development of Industrial Sites**

Location	Site Area (ha)	30% building development (ha)	floorspace (m2)	Jobs (1:50M <sup>2</sup> )
Garsen	60	18	180,000	3600
Witu	30	9	90,000	1800
Tarasaa	30	9	90,000	1800
<b>Totals</b>	<b>120</b>	<b>36</b>	<b>360,000</b>	<b>7,200</b>

### 18.11.3.2 Water Demand

Each type of manufacturing process has its own demands for water, electricity and waste treatment. Food processing, including meat, dairy and fruit, and leather tanning in particular have high demands for water. Water is used as an ingredient, for cleaning, for processing and cooking (often as steam or boiling water) and for sterilizing and sanitizing Plant machinery and areas. Typical levels of water consumption are shown in Table 18.23, which is derived from a detailed analysis in the United States by the McIlvaine Company.

In the scenario it is assumed that 12 factories are established in total within the 3 industrial parks, specialising in meat processing (2), fish processing (1), fruit and vegetable processing (2), manufacture of animal and vegetable fats (1), dairy products (2), soft drinks and water (1), tanning and leather working (1), bamboo and plaited materials (1) and botanical products (1).

The total water consumption per day by the twelve factories identified above is shown in **Table 18.23** based on the conversion of American Gallons to Litres. Total annual consumption from the twelve plants would amount to around 190 million m<sup>3</sup>. Of this a significant proportion would be discharged as waste water and could be returned to local water courses, subject to proper treatment. Actual consumption would be in the region of 17 million m<sup>3</sup>.

### 18.11.3.3 Employment and Livelihoods

Individual factories could be expected to begin operations with 5-15 employees increasing as the

businesses became more profitable and expanded. New enterprises would also be attracted over a period of time. Industrial standards do not exist for calculating the numbers of jobs per square metre but reference to the US Bureau of Statistics figures for the number of employees per premises for three of the manufacturing categories used in this scenario gives an average of 11 FTE/premises which equates to 120 workers in the twelve factories. On the other hand reference to jobs created in four new leather processing factories in Mali, Ethiopia etc by a Chinese Industrial company indicated a figure of over 100 local jobs per factory. If the assumption is made that one job is created for every 50m<sup>2</sup> of floor space the 90,000m<sup>2</sup> capacity of the potential buildings could support 7,200 workers.

### 18.11.3.4 Economic Value

Development costs<sup>8</sup> in Kenya currently range from 20,000-60,000 KSh per square metre and factories and warehousing are at the lower end, although significant additional costs would be incurred in providing road access and services to the proposed business parks.

Allowing for full development and equipment of individual factories a building cost of 25,000 Ksh per m<sup>2</sup> is allowed for the six units developed by 2030, amounting to a gross capital investment of 4 billion Kenyan Shillings (45.6 million USD). Equivalent costs would be incurred in the remaining development to 2050, bring the total construction at current prices to 8 billion shillings. If it is assumed that the typical business case for each development requires repayment of capital and interest charges (at 10%) within ten years and an

**Table 18.23 Water Demand per Day by Factory**

Manufacturing Process/no. of units	Water Use		Cooling Water		Total M <sup>3</sup> /day
	(MGD)	M <sup>3</sup> /day	(MGD)	M <sup>3</sup> /day	
Meat (2)	4.18	0.0158	10.2	0.0386	0.0544
Fish (1)	2.14	0.0081	0.3	0.0011	0.0092
Fruit and Vegetables (2)	0.2	0.0008	17.4	0.0659	0.0667
Animal and vegetable fats (1)	2.32	0.0088	5.7	0.0216	0.0304
Dairy products(2)	1	0.0038	74.6	0.2824	0.2862
Soft drinks and water (1)	2	0.0076	17.4	0.0659	0.0735
Tanning and leather products (1)		0.0008	0	0.0000	0.0008
Bamboo, rattan and cane (1)	Nominal	0	0	0.0000	0
Botanical products (1)	Nominal	0	nominal	0.0000	0
<b>Total</b>	<b>11.82</b>	<b>0.0457</b>	<b>125.6</b>	<b>0.4755</b>	<b>0.5212</b>

<sup>8</sup>Cost of building in Kenya April 19, 2012 Business Construction News

annual net profit of 12% on the investment, the gross profit (excluding tax and operating costs) would be in excess of KSh 670 million per annum in 2030 and KSh 1,344 million per annum in 2050.

Wages and salaries would contribute KSh 175 million a year in 2030 and Ksh 351 million in 2050 to the local economy, based on the current average in food manufacturing of KSh 48,750 per annum<sup>9</sup>.

## 18.12 Infrastructure

### 18.12.1 Services

Significant development of infrastructure would take place under the commercial development Scenario B in order to support commercial farming, industrial cropping and the creation of new industrial estates. Road building would be most important but potable water supplies and untreated water for irrigation would also require pipeline (and/or canal) construction.

### 18.12.2 Construction

#### 18.12.2.1 Area and Extent

There has been very limited construction activity in the Plan Area until the last two years, but with work commencing on Lamu Port and the LAPSET corridor activity is accelerating. A new 440 kv electricity power line has been erected parallel to the Malindi – Garsen road and sections of the main highway are being upgraded and tarred. Over the 40 year period covered by Scenario B there would be significant new development, including the industrial parks, but also public institutions (schools, hospitals, administration centres) local feeder roads and individual houses. A nominal area of 1,000 hectares is assumed for urban development. This analysis excludes the level of site preparation, land levelling or construction of canals and embankments that would be required for major irrigation schemes which is assessed within those

individual projects.

#### 18.12.2.2 Water Demand

Construction work requires water for site preparation, concreting and block making but these are short-term demands and do not impose a significant load on available water resources. A nominal amount of 50,000m<sup>3</sup> per annum is assumed equating to 140m<sup>3</sup>/day.

#### 8.12.2.3 Employment and Livelihoods

Construction is an important source of short term and temporary employment with both men and women being employed as labourers for site development and road construction projects. Where there is continuity of projects over a number of years some labourers will acquire specialist experience and with appropriate education and training, they will advance to positions of foremen and supervisors. It is assumed that in the region of 200-300 full time equivalent jobs will be provided annually in the Plan Area.

#### 8.12.2.4 Economic Value

Construction is treated as an economic indicator in its own right when assessing a country's economic performance and typically lies in the range of 4-8% of gross value of GDP. No data is available on current construction costs in the Tana Delta but a study by the World Bank in 2000 provides cost estimates based on a survey of 93 projects constructed between 1995-1999. Tarred roads in Kenya typically cost in excess of USD 600,000 per kilometre whereas gravel roads cost around USD 60,000 (Sogomo, 2010).

**Table 18.24** sets out some typical costs for road work. It is assumed that 2 kilometres of new feeder road will be built each year and ten kilometres of existing gravel road will be rehabilitated. The equivalent cost in Kenyan Shillings is 15 million and 21 million a year.

**Table 18.24 Indicative Costs for Construction and Repair of Roads in the Delta (2010 prices)**

Nature of work	2010 – 2030 (Annual work load)		2030-2050 (Annual work load)	
	Length	Cost (USD)	Length	Cost (USD)
New Road Construction	2	120,000	2	120,000
Existing road rehabilitation	10	60,000	20	120,000
<b>Total</b>		<b>180,000</b>		<b>240,000</b>

<sup>9</sup>[http://www.salaryexplorer.com/Kenya Manufacturing industries](http://www.salaryexplorer.com/Kenya%20Manufacturing%20industries)

### 18.12.3 Transport

#### 18.12.3.1 Area and Extent

Local transport by road and water plays a vital part in maintaining livelihoods and the economy of the Tana Delta. Canoes are used for both passenger and freight transport and every riverside village supports a number of boatmen with their own canoes. Pick up trucks and small lorries are used for moving larger freight by road, but much of the area can only be accessed on un-surfaced roads by bicycle or motorbike.

#### 18.12.3.2 Water Demand

Water plays a key role in supporting transport and can at times cause serious disruption through flooding of roads and physical damage to infrastructure. However water use is minimal.

#### 18.12.3.3 Employment and Livelihoods

Transportation is an important source of livelihoods and employment, especially for males and youths. The majority of the population will use local transport at one time or other. As a very rough estimate it is assumed that between 500-1,000 people may be engaged as drivers, hauliers or couriers in a typical day.

#### 18.12.3.4 Economic Value

Transportation, like construction, is an important component of both local and national economies since the marketing of goods and delivery of supplies and provisions would be impossible without it. In the absence of any reliable data for the value of transportation within the Tana Delta an indicative figure is derived by applying the national percentage of GDP from the 2012 National Accounts which is 12.4%. The figures for the local economy in the Tana Delta, have been adjusted accordingly by including KSh 4,658 million in 2030 and KSh 9,927 million in 2050.

## 18.13 Administration, Professional Services, Education and Health

### 18.13.1 Public Administration

Kenya has experienced rising costs of public administration, due partly to the increased expenditure on establishing new County Governments to replace the former district administrations. It will take time to stabilise the level of administration costs but eventually administrative services can be expected to expand in relation to the size of population in any given area. **Scenario B** anticipates significant economic growth within the Tana Delta and this will require strengthening of the existing administrative services to be paid for largely from increased turnover.

### 18.13.2 Professional Services

Widening and diversification of the economic sectors in the Tana Delta will only be achieved if the levels of entrepreneurial activity increase with an increasing number of professional workers in consultancy, finance, marketing, and related fields to support and train the new workforce. This sector is therefore expected to grow strongly under **Scenario B**.

### 18.13.3 Education and Health

These sectors of the local economy can be expected to grow in line with national forecasts and are a vital part of building and strengthening the future of the Tana Delta.

#### 18.13.3.1 Evaluation

No information is held on the level of employment in these service sectors of the economy although it would be reasonable to expect that national averages should apply if the Tana Delta starts to develop strongly. In order to include a realistic estimate of the importance of these sectors in the economic evaluation, the respective figures have been employed from 2012 data on Gross Domestic Product from the National Accounts. Public administration, education and health contribute 11.1% of the national economy and the equivalent percentage for Tana Delta gives a figure of KSh 4,170 million in 2030 and KSh 8,887million in 2050.

## 18.14 Urban Areas

Urban development is added to this analysis of economic activities because although it does not appear in the International Standard Industrial Classification, it forms a vital component in the overall assessment of land use change under the three scenarios.

### 18.14.1 Area and Extent

Based on the figures for population growth it is possible to estimate the number of new houses that will be required and the amount of land needed to accommodate residential buildings, schools, clinics, wells, shops, mosques and churches and other essential features of human settlement. A major issue for local communities in the years ahead will be the process of balancing the desire to maintain cultural traditions, including the nature of houses, use of livestock corrals and the layout of individual settlements and public streets against the attractions and convenience of using modern building materials including zinc for roofs and bricks and concrete in place of grass, mud and thatch.

Such issues will be for each community to resolve and there is no intention to impose standards through the Land Use Plan, but at the same time it is helpful to anticipate what are the maximum requirements for building land and public open space within each settlement. For this

**Table 18.25 Growth of Urban and Rural Settlements**

Development Component	2010 (Ha)	2010-2030 (Ha)	2030-2050 (Ha)	Total area in 2050 (Ha)
Residential Property	2,620	839	1,515	4,974
Commercial and Industrial	0	1,678	3,030	4,708
<b>Total</b>	<b>2,620</b>	<b>2,517</b>	<b>4,545</b>	<b>9,682</b>

**Table 18.26 Domestic Water Consumption**

Population	2010	2030	2050
<b>Total</b>	<b>102,000</b>	<b>174,000</b>	<b>315,000</b>
<b>Water Consumption (M<sup>3</sup>/day)</b>	<b>2,040</b>	<b>6,960</b>	<b>25,200</b>
<b>Value (KSh 100/m<sup>3</sup>) in '000s</b>	<b>204</b>	<b>696</b>	<b>2,520</b>

reason the assumption has been made that 50m<sup>2</sup> of building land should be available for family groups of 7 people with a further 200 m<sup>2</sup> for external living space, totalling 250m<sup>2</sup> (equating to 16 dwellings per acre; 40 per hectare). The area added for community use, public open space and roads / paths should match the total allocated to individual use; so a settlement of 5 houses (occupying 1,250m<sup>2</sup>) would require an additional area of 1,250m<sup>2</sup> bringing the total to 2,500m<sup>2</sup>. These estimates relate to the development of rural settlements.

In the case of the larger urban settlements, a greater area of land will be required for laying out communal, industrial, commercial and shopping areas and for providing the necessary road network. This is likely to be double the land area required for residential use. Using these figures, the growth of population by 60,000 by 2030 would require a total of 839 hectares for residential development, with a further 1515 hectares by 2050. The equivalent increase in the urban footprint to meet communal, industrial, commercial and shopping activities would be 1,678 ha by 2030 and a further 3,030 ha by 2050.

## 18.15 Water Resources

### 18.15.1 Water Consumption

Water consumption will increase with rising population and the increase in farming and livestock rearing. The use of water is accounted for under each type of economic or livelihoods activity. There is therefore no separate breakdown of information under area and demand or employment. However, it is important to note as stated for Scenario A that water has a real value, whether it is paid for as supplied by a public utility or received as a

free good as rain or collected from a river. For this reason, the value of water is calculated in these scenarios at the same rate at which is charged to communities who rely on kiosks and standpipes which is KSh 100 per 1,000 litres (1m<sup>3</sup>).

*Domestic Consumption:* The current low level of domestic water consumption, assumed to be 20 litres per head, (Mati, 2006) should rise on humanitarian grounds to a minimum of 40 litres per head by 2030 and to double this amount by 2050 (i.e 80 litres/ head) (See **Table 18.26**). This is still only half the current per capita consumption in the major urban centres of Nairobi and Mombasa.

*Livestock watering* will also add significantly to overall water consumption, as shown in **Table 18.27**. Water consumption by Zebu cattle equates to 12-20 litres/ head/day (FAO) while sheep and goats consume one tenth of this amount. Increase in the number of livestock is capped under this scenario at the 2030 level since there is insufficient land to provide grazing for any higher number of stock.

*Farming and Irrigation:* The expansion of subsistence, community and commercial farming areas will result in additional pumped and gravity irrigation schemes and create a demand for 21,600 m<sup>3</sup>/day in 2030, rising to a total of 41,000 m<sup>3</sup>/day by 2050. (See **Table 18.28**).

Total water consumption for all demands except the environmental reserve is shown in **Table 18.29**.

The equivalent flow rates to support this level of water abstraction are shown in **Table 18.30**.



**Table 18.27 Livestock Water Consumption**

Type of Livestock	Ratio (Households: Livestock)	Current (2011)	2030	2050
Cattle	10.7	211,858	362,227	362,227
Water consumption / day (M <sup>3</sup> )		4,237	7,245	7,245
Sheep	6.6	131,154	223,430	223,430
Water consumption / day (M <sup>3</sup> )		262	447	447
Goats	6	118,676	203,118	203,118
Water consumption / day (M <sup>3</sup> )		237	406	406
Camels	0.018	360	609	609
Water consumption / day (M <sup>3</sup> )		11	18	18
Total livestock water consumption / day M <sup>3</sup>		4,748	8,116	8,116

**Table 18.28 Water Demands for Farming and Irrigation (Million m<sup>3</sup>)**

Description	2010	2030	2050
Rice cultivation	35	35	70
Intensive Vegetables	2.5	3	6
Extensive Vegetables	25	30	60
Sugar cane production	0	250	500
Fruit farming	3	3	6
Total (Million m <sup>3</sup> )	65.5	321	642
Water demand M <sup>3</sup> per day	179,452	879,452	1,758,904
Value KSh (KSh100/m <sup>3</sup> )	17,945	87,945	175,890

**Table 18.29 Daily Demands for Water in 2010, 2030 and 2050 (in m<sup>3</sup>)**

Water Demand	2010	2030	2050
Domestic	2,040	6,960	25,200
Livestock	4,748	8,116	14,658
Farming and Irrigation	179,452	879,452	1,758,904
Total M <sup>3</sup> /day	186,240	894,528	1,798,762
Value KSh (Millions/year)	6.55	24.09	48.19

**Table 18.30 Effect of Abstraction on Tana River Flows**

Water Demand	2010	2030	2050
Equivalent Flow (M <sup>3</sup> /sec)	2.2	10.4	20.8

### 18.15.2 Water Sources

Water consumption for all forms of abstraction makes a very significant impact on available river flow by 2030 (taking 17% of all the water in the River Tana in 2030). This figure would rise to 35% of all available water by 2050. However direct abstraction is far less significant than the requirement which would exist to provide sufficient water to maintain grassland and rangeland in a condition capable of sustaining the massive increase in stocking density. This is assessed separately in the SEA report (Odhengo *et al*, 2014a). However, as described under the existing situation in section 14.16.1 & 14.16.2 most of the water which flows through the Idsowe Bridge is required to maintain the natural vegetation and grasslands of the Tana Delta during the dry season and any decrease in natural river flows below a monthly average of sixty cubic metres of water per second (60m<sup>3</sup>/sec) as a result of development upstream would rapidly affect the capacity of the system to maintain the livelihoods and biodiversity of the Delta. This figure of 60m<sup>3</sup>/second is referred to as the environmental reserve.

### 18.16 Biodiversity

As noted in relation to **Scenario A** there are both opportunities and challenges for nature conservation and biodiversity in the development of **Scenario B**. This section considers, first, the opportunities for promoting economic returns from commercial management and use of natural resources, followed by an analysis of some of the challenges that would be faced as a result of growth in other sectors of the economy.

#### 18.6.1 Opportunities for Economic Development

##### 18.16.1.1 Area and Extent

This scenario focuses on opportunities for commercial development and while nature conservation, the arts, entertainment and recreation are often thought of as public services there are a growing number of examples of conservation and cultural projects that are self-financing and highly profitable for their sponsors (whether private sector or communally owned). Countries like South Africa and Botswana have many very commercial and profitable game reserves but Kenya itself has been a trend setter in demonstrating the opportunities for community groups to set up tourism and game management projects, especially in the Maasai Mara. Other very significant community based projects have included the work of the Northern Rangelands Trust, which is an amalgam of more than ten Community Conservancies.

Serious game management requires major investment, including extensive fencing of the reserve perimeter, the acquisition of livestock to include species that may have traditionally occupied the area but have become

extinct, and the development of lodges and trails for 4x4 vehicles.

In the Tana Delta there are major opportunities for exploiting the existing natural flora and fauna, with boat rides into the core of the wetlands and walking/driving trails within the Primate Reserve but these activities appeal to quite a narrow sector of the wildlife tourism market and it would be necessary to broaden the appeal by developing other attractions, e.g. butterfly centres, canopy level walkways through riverine forest and cultural events within traditional village settings. Nature Kenya, as an 'extraterritorial organisation', has spearheaded development of livelihoods within six villages in the Delta over the last two years and is committed to continuing its association in the years ahead in order to strengthen the conservation of this unique series of habitats and communities. Other conservation initiatives share the same aims.

The areas which form the principal existing attractions are the primate reserve (17,000 hectares) and the core area of the Delta (70,000 hectares).

##### 18.16.1.2 Water Demand

The primary requirement to meet nature conservation needs is sufficient water to maintain the existing mosaic of habitats comprising river channels, riverine forests, open water, wet grassland and marshes, swamps and wetland. No detailed study has been undertaken to confirm the full requirements of these complex ecosystems, but the SEA has confirmed, contrary to previous assumptions, that the River Tana has historically maintained a mean monthly flow of not less than 50m<sup>3</sup> /sec below Garsen (Idsowe Bridge) except in very dry periods lasting 3-4 months in exceptional drought years. Twice yearly flooding is also a critical event for maintaining the Delta habitats and a preliminary estimate has been made in relation to the feasibility study for the High Grand Falls Dam that 0.8 billion m<sup>3</sup> of water should be released annually in two events of 400 million m<sup>3</sup> over ten days to simulate the effect of the annual floods that will be disrupted by constructing the dam

##### 18.16.1.3 Employment and Livelihoods

Nature conservation is a large untapped market which offers major opportunities for enhanced and new livelihoods in managing the natural habitat, wardening its precious wildlife reserves and harvesting natural produce. If every village community were to nominate 5 people to work full time on conservation activities this would offer a labour force of almost 500. In practice it is likely that the majority of residents will commit part of their time to nature conservation while undertaking other traditional livelihood practices.

#### 18.16.1.4 Economic Value

In many countries the natural environment, landscapes and natural resources (like beaches, rivers, waterfalls and mountains) form the main attraction for eco-tourism, sports and recreational tourism. Kenya benefits more than most from its fauna and flora, linked with the scenery and cultural assets of its national parks. Kenya is also a leader in developing innovative ways of exploiting natural assets to generate livelihoods and income for its local communities. The Northern Rangeland Trust (NRT) is one example of an umbrella organisation which promotes tourism and economic activity based on the conservation values of its Community Conservancies and the Tana Delta has followed a similar approach, albeit on a much smaller scale.

In the NRT individual community conservancies earn money from a variety of enterprises including guided tourism, managing tourism camps, and handiwork manufacture. The Sera Project in Samburu East, with a population of 8,000, operates with a budget of USD 110,000 per annum. By comparison West Gate Community Conservancy, with 3,500 people to support has a budget of USD 75,000 per year. This conservancy has leased out its tourism potential to a private company (Tamimi Co Ltd) which promotes an 18 bed luxury tented camp opened in 2007. A number of conservancy members are directly employed and a proportion of revenue is allocated to the conservancy.

Income projections for an equivalent project sponsored by the African Wildlife Foundation on community ranches on the edge of Amboseli National Park show annual returns of USD 42,000 on a ranch owned by the 248 adult members of eight families, equating to an annual income of USD 165 per adult (Kiyiapi *et al*, 2005).

It is assumed that two or three conservancies could be established for the Tana Delta, covering the coast, lower floodplain and upper floodplain, although detailed negotiations would be required with the existing community groups including the Ozi Conservation Trust, to reach agreement on the areas, structure and organisation. Using the models described above, the

aim would be to encourage all villages to join an umbrella Tana Delta Trust with three associated community conservancies.

Over the Plan period, three tourism lodges might be built with 25 bed spaces each generating \$40,000 a year. The target for annual income under the TDT would be USD 200,000 per annum, with USD 120,000 being generated by the trading activities of each of the three conservancies and the balance of USD 80,000 being attracted through International sponsorship. Other income-generating activities to be pursued by the TDT might include establishment of a local security business, the Tana Delta Scouts, which would safeguard communal interests and provide support to KWS in patrolling and monitoring wildlife and preventing poaching. A further area of conservation activity could be linked to safeguarding existing forest resources under a Carbon Credits initiative.

#### 18.16.2 Challenges

The level of development explored in **Scenario B** would greatly exceed the natural carrying capacity of the Tana Delta, not just in terms of land area but in terms of the amount of water that would be required to achieve some of the farming options. Introduction of industrial cropping within the Lower Delta would displace a wide range of existing land uses, including cattle rearing and food production and totally destroy the wet grassland habitat which forms the mainstay of the areas' international importance for biodiversity.

The cumulative effect of the commercial farming and industrial cropping schemes would largely eliminate traditional livestock rearing and the balance of landuses that are compatible with nature conservation. In practice, less than 25% of the prime habitat would remain intact by 2050.

#### 18.17 Summary

**Table 18.31** provides an overall summary of **Scenario B** which can be compared with the data given in the existing situation analysis.

**Table 18.31 Summary of Scenario B**

Component	Measure/Unit	2010	2030	2050
Population	Thousands	102	175	315
Workforce	Thousands	52	87	158
Urban Area	Km <sup>2</sup>	26.2	51.4	96.8
Industrial land	Hectares	10	70	130
Open Grazing	Area occupied	1128	530	530
	Cattle - Maximum number	735,000	11,000	11,000
	Cattle - Minimum number	220,000	11,000	11,000
	Cattle - Average number)	477,000	11,000	11,000
	Average value (KSh 12,000/head)in KSh million	5,730	132	132
Ranches (Delta)	Area occupied (Ha)	9,200	25,000	25,000
	Cattle - Maximum number	480	16,000	16,000
	Cattle - Minimum number	480	16,000	16,000
	Cattle - Average number	480	16,000	16,000
	Average value (KSh Million)@20,000/head	3.1	230	230
Farming	Subsistence (Area Km <sup>2</sup> ) 3.0 acres/HH	62	502	909
	Subsistence (Area Km <sup>2</sup> ) 1.5 acres/HH	62	105	189
	Subsistence (people supported '000s)	51	87	158
	Value of subsistence crop production (KSh million)	183	309	557
	Irrigated land (Ha)	385	15,750	31,500
	Labourers - all commercial farming	77	13,500	23,500
	Commercial farm (Has)	450	20,750	41,500
Capture Fisheries	'000Kgs/annum	613	750	1,025
	Value (KSh million)	34.5	65.3	89.2
Fish farming	Tonnes/annum	0	1,272	2,544
	Value (KSh million)	0	44.5	89
Bee keeping	Number of hives	12,150	24,000	36,000
	Honey (000 Kg)	82	240	360
	Value (KSh million)	25	72	180
Natural Products	Area for required for harvesting (Km <sup>2</sup> )	70	123	233
	People engaged	4,971	8,365	8,365
	Income generated (million)	80	134	134
	Value of building (KSh million)	325	779	779
	Charcoal / Firewood- average ('000 tonnes)	58.7	103	103
	Value of Charcoal and Firewood (KSh million)	194	396	396
Tourism	Turnover (Value '000USD)(KSh million)	26 (2.2)	50 (4.2)	75 (6.3)
Industry & Mining	Area Involved	0.5	0.5	0.5
	Turnover KSh million	257	257	257
Water Demand	Domestic (m <sup>3</sup> /day)	2,040	6,960	25,200
	Commercial/Industrial ('000 m <sup>3</sup> /day)	0	1500	1,500
	Livestock (drinking) (m <sup>3</sup> /day)	4,784	8,116	8,116
	Farming Irrigation ('000m <sup>3</sup> /day)	179	879	1,758
	Environmental Reserve (million m <sup>3</sup> /day)	5.2	5.2	5.2
Biodiversity	1,026 Km2 Prime Habitats = 100	100	<25	<25

# CHAPTER 19

## SCENARIO C – HYBRID APPROACH

### 19.1 Introduction

The descriptions of Scenarios A and B and their associated SEA assessments demonstrate very clearly that it is impractical for conditions in the Tana Delta to continue, either based on extension of existing livelihoods (as modelled in **Scenario A**), or through development of a strongly commercial focus (as postulated in **Scenario B**). Both of these scenarios would place the existing (and expanding) community of over 100,000 people in conditions of severe hardship, and would largely destroy the environmental integrity of the Delta at the same time.

This situation therefore calls for a different approach (**Scenario C**) which is based on the best elements of both **Scenarios A** and **B**, while seeking to avoid the unacceptable components. The results of this analysis are presented in this chapter.

### 19.2 Population

Under Scenario C it is assumed that the projections for future population growth in the Tana Delta are the same as in **Scenario A**.

### 19.3 Economic Activity and Methodology

The preparation of this scenario is based on the fact that the total area of the Tana Delta (2,250 km<sup>2</sup>) is finite. All activities that are required to support the

existing population (and any future growth) must be accommodated within this area. **Scenario C** also recognises that the critical relationships between communities, natural resources and biodiversity must be preserved in ways which will strengthen economic activity, reduce poverty, improve human welfare and protect the environment which, in turn, will support local livelihoods. Finally, **Scenario C** is based on the knowledge that water lies at the heart of the Tana Delta and all economic activity depends on the continued flow of the River Tana. Wise use of water resources, together with the use of land and other natural resources, holds the key to the future of the Delta.

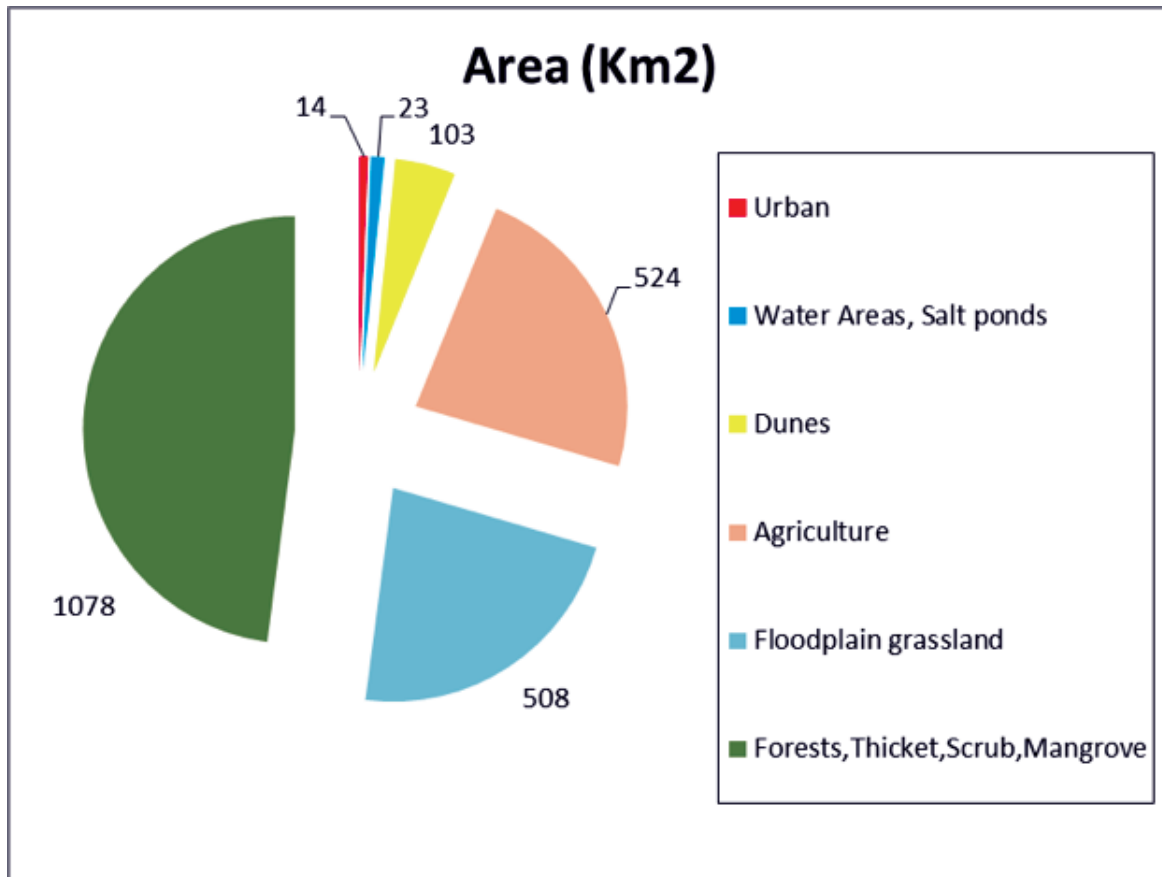
In order to assist in developing **Scenario C**, a summary of relevant information about the existing conditions is provided. **Table 19.1** and **Figure 19.1** shows a simplified breakdown of the main vegetation and land cover types that make up the Delta while **Figure 19.2** shows the same information, together with land use classes, in more detail. Finally, **Figure 19.3** shows the percentage of the Tana Delta which meets particular human needs in the form of a bar graph. These diagrams illustrate that many needs are met from the same basic resources. Analysis of **Scenarios A** and **B** through the SEA shows very clearly that if one need is allowed to dominate over others, then all will ultimately suffer.

**Table 19.1 Simplified Vegetation and Land Cover in the Tana Delta Plan Area**

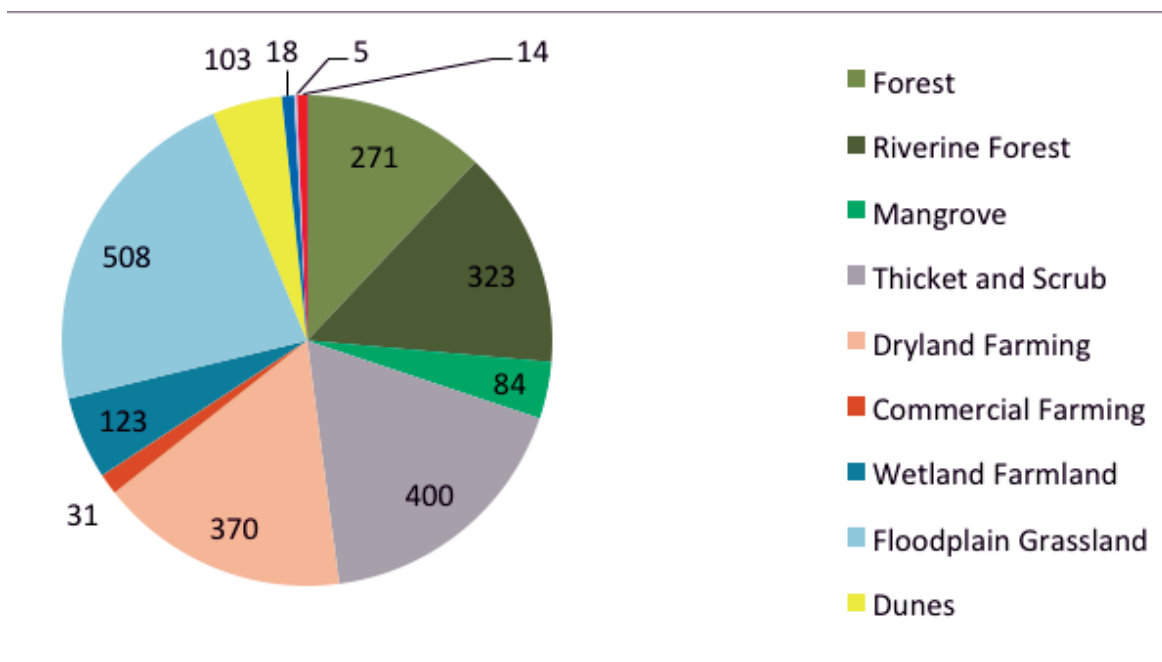
Simplified Vegetation / Land Cover	Area (Km <sup>2</sup> )
Forests, Thicket, Scrub, Mangrove	1078
Agriculture	524
Floodplain grassland	508
Dunes	103
Water Areas, Salt ponds	23
Urban	14
Total	2250



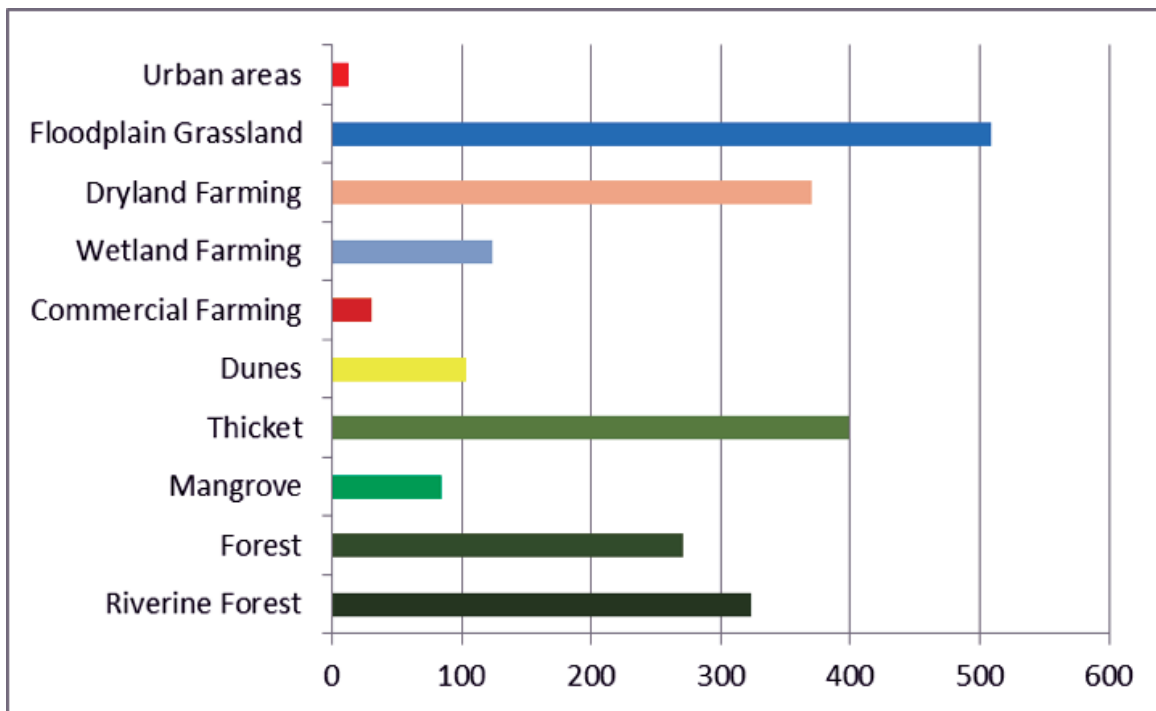
**Figure 19.1 Simplified Vegetation/Land Cover Zones with the Plan Area**



**Figure 19.2 Detailed Vegetation, Land Cover and Land Use within the Plan Area (Area Km<sup>2</sup>)**



**Figure 19.3 Different Land Use Classes Shown in Proportional Bar Graph (Area in Km2)**



**Figure 19.1** highlights the importance of tree cover within the Plan Area which extends from dense riverine forest, open woodlands, thickets and scrub through to coastal mangroves. Putting these vegetation types together amounts to almost half of the entire Plan Area. The floodplain grasslands and areas which are nominally in use for all types of agriculture each take almost a quarter of the total area, with sand dunes, open water and urban areas accounting for less than ten per cent of the total.

**Figure 19.2** breaks down the vegetation, land cover and land use into more detailed classes, and the same information is shown in a different format in **Figure 19.3**.

Further analysis has been undertaken of the range of different land uses and economic activities considered in **Scenarios A** and **B**, in order to assess how dependent their successful exploitation is on three key factors:

- Availability of Land
- Availability of Water
- Environmental Quality

The results are shown in **Figure 19.4**.

This analysis shows that availability of land is critical for all forms of agriculture, livestock rearing, natural resource use (including charcoal and fuel wood), nature protection and development of settlements. It is less important for

bee keeping, fisheries, tourism, industry and commerce. Access to water is essential for agriculture, livestock rearing, fisheries, settlements and nature conservation. Other uses also require water but it is not needed in large quantities. Finally, a different set of land uses are highly dependent on high quality environmental conditions including bee keeping, fisheries, natural resource production, tourism and settlements. It is significant that the one land use which is dependent on all three resources is nature protection and the maintenance of biodiversity.

### 19.3.1 Apportioning Land Uses

The main role of the Tana Delta Land Use Plan is to allocate land, and other natural resources like water, in order to secure sustainable development. The analysis of Scenarios A and B shows that the main demand for additional land will come from the expansion of agriculture, livestock grazing and use of natural resources.

If existing trends continue, the rise in the number of livestock in the Delta will exceed its carrying capacity in terms of grazing land well before 2030. At the same time, the need to provide food for a growing population and continued expansion in the use of natural resources will result in the impoverishment of existing grassland, and pressure for the conversion of some floodplain grassland, thicket, scrub, and forest into arable land. This

**Figure 19.4 Importance of Land, Water and Environmental Quality to specific Land Uses**

	Importance of the resource to sustainable development 1 star = low; 5 stars = high		
Land Use/Economic Activity	Land	Water	Environmental Quality
Subsistence Farming	★★★★★	★★★★★	★★
Commercial Farming	★★★★★	★★★★★	
Livestock Rearing	★★★★★	★★★★	★★
Bee Keeping	★	★	★★★★★
Fish farming	★	★★★★★	★★★
NTFP Use	★★★★★	★★★	★★★★
Charcoal & Fuel Wood	★★★★★	★★★	★★
Tourism	★★	★	★★★★★
Nature Protection/Use	★★★★★	★★★★★	★★★★★
Settlements	★★★★★	★★★	★★★★★
Industry/Commerce	★★	★★	
Trading/Marketing	★	★	

situation cannot be allowed to develop and a firm Land Use Plan needs to be put in place to correct these long term trends and achieve a sustainable balance between communities, land uses and the environment.

### 19.3.2 The Decision-making Process

In the past, processes for deciding how land was allocated within the Tana Delta are widely accepted to have been arbitrary, non-transparent and operated for the benefit of elites and influential individuals rather than the wider community. This has resulted in land allocations which have never been properly used or managed which then become a blight on other genuine efforts to create new enterprises and raise standards of living for everyone rather than the select few.

The 2010 constitution, new government structures and new laws provide an exceptional opportunity to correct these imbalances and it will fall to the two County Governments to demonstrate that they can rise to the occasion and put in place a Land Use Plan for the Tana Delta Plan Area which is genuinely designed to resolve existing land ownership issues and create a forward-looking strategy for prosperity. There are some big challenges ahead and this scenario illustrates some of the choices that will have to be made.

### 19.3.3 Developing a Land Use Strategy

The Tana Delta Plan Area has reached a crossroads in terms of its future development. A number of options can be envisaged:

(a) *Business as usual* would see continuing appropriation of land which is technically in public ownership as individual developers seek ways of promoting their own vested interests. Critical habitats and land in communal use would be converted to commercial and other uses, leaving existing users angry and frustrated and leading to greater insecurity, tensions and conflict.

(b) *Self-Sufficiency*: This approach would provide every household with the scope and freedom to develop sufficient land to meet its own needs and work its way out of poverty. However, previous attempts to establish resettlement areas in the Tana Delta have failed for a variety of reasons, including the sale of land by the beneficiaries to raise instant finance, leaving large areas in the hands of absentee landowners. A self-sufficiency approach could lead to a myriad of small uncoordinated developments with no real overall benefit in terms of the economy, social welfare or environmental improvement.

(c) *Community led enterprise*: would see community leaders and local government take the initiative in planning and developing community projects in farming, livestock rearing, and commerce. This approach would help to ensure full commitment and a sense of purpose for all residents of the Tana Delta, but the necessary expertise and business acumen might not be drawn in from individual entrepreneurs so progress could be much slower than anticipated.

(d) *Public/Private Partnerships*: advice, expertise and finance of commercial and business development

companies and individual specialists to work alongside community personnel and government departments to promote joint projects.

The choice of strategy is a communal decision to be guided by political leaders and it needs to be taken following a thorough debate about the options outlined above. However in order to develop this scenario it has been necessary to form a judgement on which option or options might offer the best solution and, for planning purposes, an amalgam of (b), (c) and (d) has been adopted.

It is assumed that a formal Land Use Plan will be prepared to be implemented through a combination of individual enterprise, communal activities and private/public partnership. Allocation of land will need to be kept under constant review to ensure effective use and the practice of granting thousands of hectares to individual companies (whether public or private) is stopped.

### 19.3.4 Framework for Land Allocation

A framework for land allocation is proposed in Scenario C with the aim of protecting the special environmental qualities of the Delta and achieving a balanced approach towards sustainable development which respects and gives equal weight to the two main land uses of livestock rearing and agriculture. In broad terms, the concept is to allocate just under one third of the Plan area to livestock rearing (29%), a similar amount to agriculture (29%), and a little more than one third to uses which are entirely compatible with nature conservation (39%) (together with zones for urban and industrial development (3%) ).

#### 19.3.4.1 Livestock Rearing

The most important area for grazing livestock is the part of the River Tana floodplain which covers 508 km<sup>2</sup> in the Upper and Lower Delta. Part of the terrace areas covered by thicket and scrub provide additional grazing and Scenario C envisages that the total area available for grazing of one kind or another should be maintained at 650 km<sup>2</sup>.

#### 19.3.4.2 Agriculture

An equivalent area of land should be reserved in the long term for agricultural use. At the present time only 31 Km<sup>2</sup> is used for commercial farming and 6 Km<sup>2</sup> for arable use within communities. However, up to 45% of the Plan Area has potential to be used for agriculture and large parts of the land use zones referred to as dryland (370 Km<sup>2</sup>) and wetland farming (123 Km<sup>2</sup>) are cultivated on a rotational or seasonal basis. Taking these classes of land together gives a total of 524 Km<sup>2</sup> for agricultural use, to which is added a further 76 Km<sup>2</sup> of land classified as thicket and scrub to match the 650km<sup>2</sup> allocated to livestock grazing.

#### 19.3.4.3 Urban and Commercial Uses

If livestock rearing and agriculture are each allocated 650 Km<sup>2</sup> of land this leaves 1,050 Km<sup>2</sup> within the Plan Area. Sufficient land also needs to be set aside to accommodate the existing urban and commercial uses in the Delta, and to provide for unrestricted commercial and industrial growth in the 35 years up to 2050. This represents an area of 60 Km<sup>2</sup>, or 2.7 % of the total Plan Area, and reduces the balance of unallocated land to 980 Km<sup>2</sup>.

#### 19.3.4.4 Uses Compatible with Nature Conservation

In terms of protecting the core areas of nature conservation interest and biodiversity it is proposed that the primary habitats that support both natural resource use, but also components of other uses like agriculture, livestock rearing, tourism and bee-keeping, should be maintained and conserved at close to their present area and extent. These habitats are listed in **Table 19.2** and together cover 1,407 square kilometres or 62% of the total Plan Area.

If the 508Km<sup>2</sup> of floodplain grazing, which serves a dual purpose for conservation and grazing, is excluded from the equation, the remaining 899 Km<sup>2</sup> of land under conservation management accounts for 40% of the land within the Delta. However, the floodplain constitutes a large part (508 Km<sup>2</sup>, or 36%) of this high value habitat, and long term protection of its biodiversity interests neatly coincides with its continued proper management and use for livestock grazing.

**Table 19.2 Habitats to be Managed for Nature Protection and Biodiversity**

Primary Habitats	Area (Km <sup>2</sup> )
Forest	271
Riverine Forest	323
Mangrove	84
Open water	18
Dunes	103
Migratory routes	100
Floodplain grassland	508
<b>Total</b>	<b>1,407</b>

**Table 19.3 Proposed Breakdown of Land Uses**

<b>LAND USE</b>	<b>AREA (Km<sup>2</sup>)</b>	<b>%age</b>
<b>LIVESTOCK</b>		
Floodplain	508	
Thicket	142	
<b>Sub Total</b>	<b>650</b>	<b>29</b>
<b>AGRICULTURE</b>		
Dryland Farming	370	
Commercial Farming	31	
Wetland Farmland	123	
Conversion from Thicket	126	
<b>Sub Total</b>	<b>650</b>	<b>29</b>
<b>NATURE CONSERVATION COMPATIBLE USES</b>		
Forest	271	
Riverine Forest	323	
Mangrove	84	
Dunes	103	
Water Areas	18	
Migration corridors through thicket	86	
<b>Sub Total</b>	<b>885</b>	<b>39</b>
<b>URBAN AND DEVELOPMENT</b>		
Salt Ponds	5	
Urban Areas	60	
<b>Sub Total</b>	<b>65</b>	<b>3</b>
<b>TOTAL</b>	<b>2,250</b>	<b>100</b>

Apart from livestock rearing improvements and the intensification of agricultural operations, the main change proposed in land use is the conversion of 126Km<sup>2</sup> of thicket and scrub to agriculture over the plan period. In summary, the proposed breakdown of land uses within the Plan Area is set out in **Table 19.3**.

In the sections which follow, outline strategies are described for each of the principal land uses.

## **19.4 Livestock Management**

There is no prospect of achieving an equitable balance between human activities and environmental and social concerns unless the expansion in the number of livestock, as illustrated in **Figure 19.5**, is brought under control.

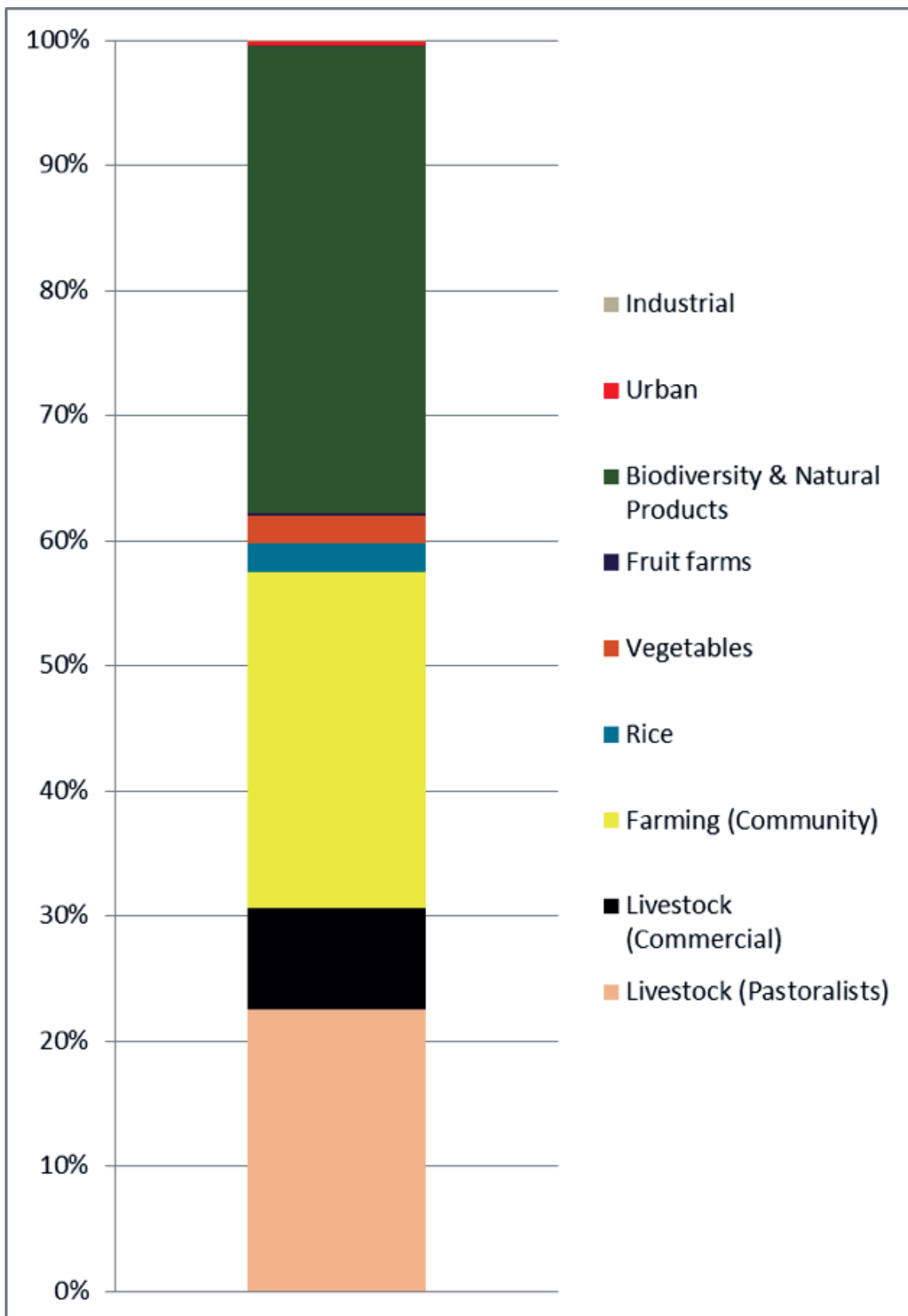
However, this could only be achieved if a fundamental change in attitude is adopted by pastoralists; this would entail keeping fewer animals per household but ensuring that the quality and health of those remaining is greatly improved.

### **19.4.1 Area and Extent**

It is clear from recent development in the Tana Delta that some of the stereotype views about local cultures are not entirely accurate. Some Orma villages have developed very substantial farming operations with cash cropping as well as subsistence farming being used to support the traditional livelihoods of cattle rearing, whereas some Pokomo farmers have invested in livestock.



**Figure 19.5 Proportional Breakdown of Different Land Uses within the Delta**



An important part of the debate about future land management in the Tana Delta needs to focus on how livestock are kept. The options include:

- Livestock keeping continues to follow the traditional pattern where some very wealthy owners maintain individual herds of cattle, goats and sheep containing thousands of animals, while poor households have only a few cattle,
- Communal ranching is developed, and/or
- New forms of public/private partnership are developed.

Decisions on these options will help to inform the long term plan for livestock management; but, for planning purposes within **Scenario C**, certain assumptions have had to be made as follows. The total area of land potentially available to livestock rearing and grazing is around 510 km<sup>2</sup> within the floodplain, with some additional dry grazing within the thicket areas on the terraces. Based on a total area of 650 Km<sup>2</sup>, around 29% the Delta would be utilised for grazing in the period up to 2050. This represents a slight reduction in the area presently grazed since livestock are currently allowed to range over most parts of the Delta, regardless of the existence of other uses.

Any reduction in grazing area should be compensated for through a programme that is designed to improve animal husbandry, introduce new blood strains of cattle and extend artificial insemination in order to increase the vigour and productivity of cattle in the Tana Delta. Improved access to watering points, the designation of droving routes and safeguarding of approved communal grazing areas will help to reduce conflict and ensure greater resilience to drought conditions. Water flows in the Lower River Tana will be monitored and abstraction upstream will be regulated and controlled to ensure that livestock have all the water they need.

#### 19.4.2.1 General Livestock Grazing

Under this scenario, the maximum number of cattle to be grazed within the Tana Delta during the wet season would be 200,000 while in the dry season the number in the Delta Plan Area would be limited to 600,000 head. During the rainy seasons, cattle would be moved into the arid rangelands forming the main buffer zones to the Delta.

Land available for general grazing would be restricted to half of the available wet grassland within the floodplain. The other half would be reserved for the special grazing scheme described in **Table 19.5**.

#### 19.4.2.2 Special Livestock Grazing

A separate measure for increasing the productivity and profitability of cattle rearing in the Tana Delta would be to develop a rearing and fattening/marketing initiative, whereby an area of up to 25,000 hectares would be set aside and carefully managed as a grazing area for cattle purchased selectively from individual pastoralist families. These cattle would be fattened on the managed grazing area for six months before being transferred to a purpose built abattoir in Garsen. The carcasses would be transferred in cold storage trucks to Mombasa and Nairobi, where they would command premium prices, estimated at KSh 17,500 due to their origin under the 'Tana Delta' Brand. Cattle purchased for this marketing cooperative would attract a premium of between 20-30% above the existing market prices in Garsen. This increase would more than compensate owners for the reduction in the overall number of cattle being kept in the Delta. The commercial elements of this ranching system would be operated under a cooperative venture to be established amongst competent pastoralists from the Delta Area. This type of scheme could be introduced on individual ranches, but it would be preferable to introduce a single, well managed operation rather than a series of individual initiatives. The basics of this scheme are set out in **Table 19.5**.

**Table 19.4 Grazing of Livestock by Individual Pastoralists**

General Livestock rearing	Km <sup>2</sup>	Stocking Density	Head (No)	Value (KSh)	Total (KSh Million)
Wet grassland	250	2/ha	50,000	12,000	600

**Figure 19.5 Proportional Breakdown of Different Land Uses within the Delta**

Cattle Rearing/Fattening Project	Km2	Stocking Density	Head (No)	Value (KSh)	Total (KSh Million)
Wet grassland holding area	250	2/ha	50,000	17,500	875
Dry grassland	150	1/3ha	50,000	12,000	600
<b>Total</b>	<b>400</b>				<b>1,475</b>

**Table 19.6 Water Demand by all Livestock**

All livestock	2010	2030	2050
Daily demand (m <sup>3</sup> )	4,240	3,000	3,000
Annual Demand (m <sup>3</sup> )	1,548,330	1,095,000	1,095,000

**Table 19.7 Employment in Livestock Rearing**

Employment	2010	2030	2050
Head of cattle	220,000	150,000	150,000
Employment (FTE)	2,200	1,500	1,500

**Note:** The number of cattle shown for dryland areas includes animals covered by the special purchasing scheme for livestock owned by pastoralists without grazing rights in the Delta. In times of drought, cattle management becomes very problematic since many pastoralists from remote areas drive their animals into the Tana Delta to find grass and water. In order to introduce an element of control it is proposed that all non-resident pastoralists wishing to graze their cattle in the Delta in dry periods would be required to register their names and their place of origin at the beginning of each year. Non-resident pastoralists would then be required to pay a nominal fee to cover grazing of a fixed number of animals for a fixed period of time. Permits would be granted by the County governments, subject to careful monitoring to ensure that the cumulative total of the number of registered cattle remaining below the ceiling of 600,000. Preference would always be given to those pastoralists having permanent residences in the Delta. During droughts, the borders of the Delta would be policed by rangers to ensure that only registered animals were admitted.

A purchase scheme would be set up to buy cattle from those herders from remote areas without permits who would otherwise face severe hardship. These poorer quality cattle would be slaughtered at the abattoir and the meat would be processed in a Garsen factory to avoid compromising the Tana Delta brand for quality produce.

#### 19.4.2 Water Demand

Water demand is based on a maximum of 150,000 cattle during the wet season in the Tana Delta and up to 600,000 in the dry season with an additional 10% consumption by sheep and goats, as shown in **Table 19.6**.

#### 19.4.3 Employment and Livelihoods

The number of livelihoods supported by open grazing cattle herding would fall from its present estimated level of 2,200 FTEs to around 1,500 FTEs, (see **Table 19.7**) but a significant number of the new jobs would attract a fixed wage rather than random payment in kind under existing provisions.

#### 19.4.4 Economic Value

The gross value of stock would be in excess of KSh 1,475 million (See Table 19.5).

### 19.5 Agriculture

The social, economic and environmental implications of this major component of Scenario C are discussed first under each of the sub-categories (subsistence cultivation and communal/private sector partnership farming). Overall characteristics are then discussed for the area/extent, water demand, employment and livelihoods and economic value.

#### 19.5.1 Area and Extent

The current area of land which is used for some form of agriculture in the Plan Area consists of 370 km<sup>2</sup> of dry farming (in thicket and scrub), wetland cultivation on 123 km<sup>2</sup> in the flood plain and general farming mainly along the river banks amounting to 31 km<sup>2</sup>, making a total of 524 km<sup>2</sup>. Much of the dry farming area is under-utilised and cultivation could be intensified with appropriate inputs of fertilizer, improved cultivation practices and provision of water from local dam storage and pumped irrigation. In addition some of the wetland farming areas could be improved. In order to allocate an average of 3 acres (1.21 hectares) per household to the existing population and new households formed in the period up to 2030 (15 years) a total of 230,000 hectares would need to be allocated and improved. Over the Land Use Plan period the proportions of land in different land use classes would change as shown in Table 19.8 with a gradual reduction in areas of dry and wet farmland and their conversion to more intensive uses. This would include 101 km<sup>2</sup> under communal/commercial PPP schemes (rice, irrigated and extensive vegetables, fruit farming).

Land used by individual households to grow food for subsistence forms a separate category from the larger areas of dry land farming on the terraces and wet land farming areas in the floodplain. The latter areas cover 37,000 and 12,300 hectares respectively, amounting to 49,300 hectares in total. Land being used for subsistence farming and for dry land and wet land farming (56,300 ha) currently accounts for 25% of the Delta. In order to raise this to the same percentage as land used for grazing (i.e. 65,000 ha) a total of 8,700 ha would be converted to farmland from existing thicket and scrub by 2050 as shown in Table 19.8. Within the overall total of 65,000 ha of farmland a number of areas suitable for intensive production (10,100ha) would be selected for rice, vegetables and fruit farming as described in the sections that follow, while 25,000 ha would be retained in subsistence use. This leaves 29,900 ha of rain-fed agricultural land being managed by individual farmers, community groups and cooperatives involving communities working with the private sector in PPP schemes.

#### 19.5.2 Types of Farming Structure

Two categories of farming practice are discussed; subsistence farming by individual households and, community/PPP initiatives involving irrigation or rain-fed agriculture

##### 19.5.2.1 Subsistence Farming

The analysis undertaken in Scenario A and B suggests that the current distribution of 1.5 acres of agricultural land per family is too small to achieve self-sufficiency and, in order to reduce poverty, the amount of land available for local food production should be increased to the equivalent of 3 acres per household. As discussed in section 19.3.2, there are options in terms of the way

**Table 19.8 Conversion of Land to Farmland 2010-2050**

Farming Practice	2010	2030	2050
	(kms2)	(kms2)	(kms2)
Dryland general purpose farming	370	262	215
Wetland general purpose farming	123	100	84
Household Subsistence farming	6	203	250
Rice cultivation	3	31	31
Intensive vegetables	0	30	40
Extensive vegetables	0	10	10
Fruit farming	0	10	20
Thicket to be converted	148	4	0
Total	650	650	650

such additional land is allocated. It could be held on a communal basis or distributed to individual households. There would be merit in a communal approach since this would avoid perpetuating the gradual encroachment of farmland into grazing and other areas of the Tana Delta as the population rises.

A major drawback of distributing land to individual households arises from the traditional practice of dividing land equally between sons on the death of the entitled landholder, resulting in progressive subdivision of land holding. In the event that a scheme for distribution to individual families is developed, this should be subject to a formal agreement, requiring this land to be passed to a single relative (male or female) on the death of the holder. This would mean that other assets would need to be found to provide support to other relatives, but it would also encourage parents to consider limiting the size of their families on an entirely voluntary basis.

Regardless of the type of scheme adopted, the amount of land required to meet the objective of self-sufficiency in food production in the Plan Area would increase from the current nominal 7,000 hectares in 2010 (0.6 ha or 1.5 acres per Pokomo Household), to 20,130 hectares in 2030 in order to meet the current projected rise in population and an increase in land per household to 1.2 hectares (3 acres), although it is hoped that voluntary efforts to reduce the population growth rate would help to stem the demand for land. Beyond 2030, increasingly stringent rules would need to be introduced to limit the amount of land being converted to farmland for individual use so that by 2050 a maximum allocation of 25,000 hectares would be reached.

#### *19.5.2.2 Community/Public-Private Partnership Farming Schemes*

Evidence from other parts of the continent and developed economies world-wide shows that communal initiatives or public-private partnerships are likely to be more efficient and cost effective than individual small holder operations, and it would be appropriate for a range of different models to be tried and tested in the Tana Delta, from full community-owned and managed 'farming cooperatives' to partnerships between private sector investors and community operators. Two models are considered; the first would involve irrigation in areas close to the River Tana, while the second would concentrate on areas with rain-fed agriculture.

### **19.5.3 Types of Cropping Regimes**

Two categories of cropping regime are considered; the first emphasises opportunities for irrigation while the second focuses on rain-fed agriculture.

#### *19.5.3.1 Irrigated Crops*

Indicative proposals have been developed for rice, intensive salad-type vegetables and fruit farming. Industrial crops are specifically excluded because of their higher water demands.

**Rice:** This proposal would allow for up to 3,000 hectares of rice to be grown in several different locations within the Upper and Lower Delta. It is assumed to include the existing area of 2,000 hectares which is currently managed by TARDA. Under this scenario it is assumed that TARDA, or any successor government agency, would relinquish its role as farm manager and concentrate instead on provision of infrastructure services and technical advice. Over time the need for government involvement would reduce and its role would be taken over by private sector advisors who would be paid by results. The preferred location for the additional rice holding would be either on land formerly included in the Tana Delta Integrated Project to the south of Gamba, or in the Upper Delta.

**Intensive Vegetable Farming:** A number of communal farms would be developed close to existing villages, each cultivating irrigated vegetables for sale in local markets, but also through a distribution network to major centres like the new port of Lamu, Garissa and Mombasa. The average size of each farm would be 50 hectares, resulting in the creation of up to eighty new farms on 4,000 hectares. A further 1,000 hectares would be allocated for farming extensive crops like maize, sunflower and legumes.

**Fruit Farming:** 2,000 hectares of new fruit orchards would be planted with an average size of 50 hectares.

#### *19.5.3.2 Rain-fed Cropping*

The largest area of farmland in the Delta (30,000 Ha) distributed between existing wet and dry farming areas and unreclaimed thicket and scrub is too remote to be irrigated by gravity or pumped supplies but its productivity could be increased through wise use and management, including rain-water harvesting in small dams and use of conservation farming techniques. This type of farming would have the same characteristics as extensive vegetable growing.

### **19.5.4 Assessing the Individual Proposals**

In the subsections which follow each type of farming enterprise is assessed in terms of area and extent, water demand, employment and livelihoods and economic value.

#### *19.5.4.1 Area and Extent*

The areas to be allocated to each individual crop are shown in **Table 19.9**.



**Table 19.9 Breakdown of Types of Agricultural Practice and Cropping**

Farming Practice	2010	2030	2050
	(kms2)	(kms2)	(kms2)
Dryland general purpose farming	370	262	215
Wetland general purpose farming	123	100	84
Household Subsistence farming	6	203	250
Rice cultivation	3	31	31
Intensive vegetables	0	30	40
Extensive vegetables	0	10	10
Fruit farming	0	10	20
Thicket to be converted	148	4	0
<b>Total</b>	<b>650</b>	<b>650</b>	<b>650</b>

**Table 19.10 Growth in Water Demand in Agriculture (2010-2030)**

Crop type	E-T Water uptake (mm)	Demand m <sup>3</sup> per hectare	Area (Ha)	Total M <sup>3</sup> /area	Growing Season (days)	Consumption (m <sup>3</sup> /day)	m <sup>3</sup> /sec
Rice	700	7,000	3,100	21,700,000	150	144,667	1.67
Intensive Vegetables	600	6,000	2,000	12,000,000	150	80,000	0.93
Extensive Vegetables	600	6,000	500	3,000,000	150	20,000	0.23
Fruit farming	1,200	12,000	1,000	12,000,000	365	32,877	0.38
<b>Totals</b>			<b>6,600</b>	<b>48,700,000</b>		<b>277,543</b>	<b>3.2</b>

**Table 19.11 Growth in Water Demand in Agriculture to 2050**

Crop type	E-T Water uptake (mm)	Demand m <sup>3</sup> per hectare	Area (Ha)	Total M <sup>3</sup> /area	Growing Season (days)	Consumption (m <sup>3</sup> /day)	m <sup>3</sup> /sec
Rice	700	7,000	3,100	21,700,000	150	144,667	1.67
Intensive Vegetables	600	6,000	4,000	24,000,000	150	160,000	1.85
Extensive Vegetables	600	6,000	1,000	6,000,000	150	40,000	0.46
Fruit farming	1,200	12,000	2,000	24,000,000	365	65,753	0.76
<b>Totals</b>			<b>10,100</b>	<b>75,700,000</b>		<b>410,420</b>	<b>4.8</b>

**Table 19.12 Employment and Livelihoods in Agriculture**

Job Creation (Number of FTEs)	2,010	2,030	2,050
Household Subsistence farming	19,885	33,550	60,595
Rice Cultivation	30	310	310
Intensive Vegetables	0	12,000	16,000
Extensive vegetables	0	50	100
Fruit Farming	0	5,000	10,000
Rain fed farming	0	1,500	2,990
	<b>19,915</b>	<b>52,410</b>	<b>89,995</b>

#### 19.5.4.2 Water Demand

The growth in demand for water will be significant given the emphasis on irrigated vegetable and fruit production, in addition to a ten-fold increase in the current area under rice production, as shown in **Table 19.10** and **19.11**. However, the amount required is less than half the amount that would be needed to grow some very water-intensive crops like 20,000 hectares of sugarcane as reviewed in **Scenario B**.

#### 19.5.4.3 Employment and Livelihoods

The expansion of land under subsistence farming would assist a total of 16,775 households (50% Of the entire population in the Plan area) to become self-sufficient in food by 2030. Other households engaged in pastoralism would be supported through the livestock programme but could also benefit directly in communal/private sector farming initiatives. The number of livelihoods supported by subsistence agriculture, given average

farm sizes over 3 acres would exceed 70,000 FTEs (at 2 FTEs per smallholding). For areas under dry land or wet land cultivation, some parts are already farmed, but if the same figure is applied of 50 FTEs per 1,000 hectares as is used for irrigated extensive cropping the total livelihoods involved would be in the region of 1950.

In addition to livelihoods in subsistence farming and rain-fed agriculture a substantial number of new jobs would

be created within the irrigated farming enterprises. These would include over 200 FTEs in rice cultivation, 6,000 in intensive vegetable production, 50 in extensive vegetable farming and 6,000 in fruit farming, giving a total of 12,250 new jobs by 2030. Continuing expansion of agriculture would add 1,000 jobs in intensive vegetable production, and another 6,000 in fruit farming (7,000 in total by 2050), as summarised in **Table 19.12**.

**Table 19.13 Overall Performance of New Agricultural Enterprises in 2030 and 2050**

Project / Scheme	2030	2050
<b>Rice Farms</b>		
Area (Ha)	3100	3100
Water Demand (million m <sup>3</sup> )	21.7	21.7
Employment	310	310
Production (Tonnes)	15,500	21,700
Gross Turnover (Million USD)	7.75	10.85
<b>Intensive Vegetable Farms</b>		
Area (Ha)	3000	4000
Water Demand (million m <sup>3</sup> )	12	24
Employment	12000	16000
Production (Tonnes)	127,500	170,000
Gross Turnover (Million USD)	22	44
<b>Extensive Vegetable Farms</b>		
Area (Ha)	1,000	1,000
Water Demand (million m <sup>3</sup> )	3	6
Employment	50	50
Production (Tonnes)	3,100	3100
Gross Turnover (Million USD)	8.3	16.6
<b>Fruit Farms</b>		
Area (Ha)	1000	2000
Water Demand (million m <sup>3</sup> )	12	24
Employment	5000	10000
Production (Tonnes)	18,340	36,680
Gross Turnover (Million USD)	5.7	11.4
<b>Rain-fed Agriculture</b>		
Area (Ha)	15000	29900
Water Demand (million m <sup>3</sup> )	0	0
Employment	1495	2990
Production (Tonnes)	46500	92,690
Gross Turnover (Million USD)	24.9	49.6

**Table 19.14. Value of Food Production through Subsistence Farming**

Assessment Criteria	Year		
	2010	2030	2050
All Households in Delta	19885	33550	60595
Farming HH in the Delta	9,943	16,775	30,298
Nominal value of food produced KSh Million	183	309	557

**Table 19.15 Summary of New Agricultural Enterprises**

Category	2030	2050
Area (Ha)	23,100	40,000.0
Water Demand (Million m3)	48.7	75.7
Employment (Thousands)	18,905	29,350
Gross Turnover (Million USD)	69	132
Gross Turnover (KSh Million )	5,767	11,129

#### 19.5.5.4 Economic Value

The value of subsistence farming as set out in **Table 19.14**, is based on the calculations and assessment in section 16.5.4.

The gross value of the new farming enterprises has been assessed as USD 69 Million (KSh 5767 million) in 2030 and USD 132 Million (KSh 11,129 million) in 2050 (see **Table 19.15**). The overall performance of new agricultural enterprises is summarised in **Table 19.15**.

## 19.6 Fishing and Fish Farming

Two different aspects of fishing and fisheries need to be considered. These are freshwater and marine capture fisheries and aquaculture or mariculture.

### 19.6.1 Capture Fisheries

#### 19.6.1.1 Area and Extent

Coastal fishing from Kipini is currently restricted in its extent by the local fishermen's dependence on canoes that are not designed to cope with deep and rough water conditions. Foreign fishing fleets fish in deeper water. The development of a marine fishery would require creation of a permanent harbour near the mouth of the River Tana and purchase of sea-going fishing vessels. Both objectives would be difficult to realise due to the dynamic nature of the River Tana estuary with shifting sand banks and severe coastal erosion, and the high cost of buying and equipping sea-going fishing boats. In addition, strong competition would exist from Malindi and from the planned industrial fishing port at Lamu, planned as part of the LAPSET initiative.

An alternative to industrial scale marine fishing could be to concentrate on sport fishing, using fast, lightweight recreational vessels to take fishing parties on day trips to catch marlin, sharks and other game fish. This type of fishing would require significant development of the tourism infrastructure to attract wealthy patrons and would, again, be in competition with established resorts. For these reasons, the development of the marine fishery is seen as a relatively low priority.

Fish capture from lakes, rivers and the sea will continue to provide an important source of food protein and income, and its success will depend largely upon external factors, including the maintenance of long term mean and flood flows in the River Tana and nutrient levels and temperature in the Somali offshore current, and internal factors including the nature and sophistication of fishing gears. Most freshwater fish capture is based on wild stock which breed in the shallow waters after flooding events and then congregate in the main river channels and larger lakes like Moa as water levels fall. The main limiting factor in terms of productivity is water availability.

#### 19.6.1.2 Water Demand

Freshwater capture fisheries are entirely dependent upon the maintenance of the River Tana's flow regime which includes periods of drought and annual flooding. Breeding cycles of many freshwater species are geared to the periods of flooding when inundation of rich grassland creates ideal conditions for fish fry to feed before migrating to the main river channels where fish reside during periods of low flow. Interruptions to this natural cycle through reduction in flood flows has had

**Table 19.16 Employment in Freshwater and Marine Fisheries**

All livestock	2010	2030	2050
Daily demand (m <sup>3</sup> )	4,240	3,000	3,000
Annual Demand (m <sup>3</sup> )	1,548,330	1,095,000	1,095,000

**Table 19.17 Freshwater and Marine Capture Fisheries Extrapolated to 2030 and 2050**

Description of fishing activity	2010		2030		2050	
	Yield (kg)	Value KSh Million	Yield (kg)	Value KSh Million	Yield	Value KSh Million
Fresh water	394,000	34278000	500,000	43500000	750000	65250000
Marine	220,000	220,087	250,000	21750000	275000	23925000
Totals	614,000	34,498,087	750,000	65,250,000	1,025,000	89,175,000

Marine species accounted for 36% of the catch in 2007. Price KSh 86/kg

**Table 19.18 Fish Farm Development in the Delta to 2030 and 2050**

Element	2030	2050
Number of Fish ponds	530	1060
Total surface area (Hectares)	26.5	53
Number of fish stocked as fingerlings /year	180,200	360,400
Yield / Tonnes / Hectare	5.5	5.5
Total weight harvested (Tonnes/annum)	1,272	2544
Value of fish harvested (KSh million)	44.5	89

severe adverse impacts on freshwater capture in lakes like Moa and the main river.

There are no direct demands on freshwater for marine fisheries, but discharge of water from the River Tana is thought to play a critical role in delivering nutrients (through sediment load) to the Indian Ocean and helps to maintain the quality of the offshore fisheries. Freshwater also plays a key part in forming the brackish water which supports various mangrove species that, in turn, provide breeding and nursery grounds for many species of marine fish and shellfish.

#### 19.6.1.3 Employment and Livelihoods

The number of individuals who gain a FTE livelihood from capture fisheries is estimated in **Table 19.16**.

#### 19.6.1.4 Economic Value

Projections of the value of freshwater and marine capture fisheries are shown in **Table 19.17**.

### 19.6.2 Aquaculture and Mariculture

#### 19.6.2.1 Area and Extent

A more promising opportunity exists to promote aquaculture, and possibly mariculture, in some parts of

the Tana Delta. Pilot projects have shown that fishponds can be constructed and stocked with Tilapia to provide a continuous source of fresh fish for individual communities. There are some significant challenges, including the risk of flooding which allows fish to escape, but with good design and proper management there is great potential for extending the commercial possibilities of aquaculture. **Table 19.18** shows the projected increase in production and income from constructing two fish farms for each village as modelled under **Scenario B**. The same assumptions are applied in **Scenario C**.

#### 19.6.2.2 Water Demand

The critical issue for all forms of fishing and fish farming relates to the availability of good quality water at essential periods in the fish breeding and rearing cycle. Precise quantities cannot be estimated but the basic requirement to satisfy maintenance of healthy river and oxbow lake fisheries will be preservation of the environmental reserve and minimum flow of 60m<sup>3</sup>/sec in the River Tana.

### 19.6.2.3 Employment and Livelihoods

The number of livelihoods supported by aquaculture has been estimated in section 18.6.3. The same assumptions would apply under Scenario C and on this basis 106 full time jobs would be created with a further one full time equivalent position (shared by ten assistants) for each community making 212 jobs in total.

### 19.6.2.4 Economic Value

Estimates of the value of fish harvesting are shown in Table 19.18.

## 19.7 Bee Keeping

### 19.7.1 Area and Extent

The assumption made under Scenarios A and B would apply with equal relevance to Scenario C. Bee keeping can be practised throughout the Tana Delta but especially in areas with substantial tree cover.

### 19.7.2 Water Demand

Water is essential for bees but the quantities involved are not significant in terms of the overall balance of supply and demand.

### 19.7.3 Employment and Livelihoods

The number of full time jobs that could be created in beekeeping is estimated at 140 in 2010, 480 in 2030 and 720 in 2050. Based on part time beekeeping to supplement other forms of income, with an average yield of 50 kg per beekeeper the numbers would be 1,460, 4,800 and 7,200 respectively.

### 19.7.4 Economic Value

Providing the main conservation habitats are properly maintained there would be major opportunities for each community to develop a strong trade in honey, wax and propolis as a result of increasing the number of modern bee hives and introducing mechanised processing and bottling of honey. The projections of the increase in yield, and value of projection are carried forward from the previous scenarios as shown in Table 19.19.

**Table 19.19 Projections of Honey Production from 2010 to 2030 and 2050**

Year	2010	2030	2050
No of Hives	12,150	24,000	36,000
'000 Kgs	68-96	240	360
KSh Million	20-29	72	180

## 19.8 Natural Resources

This scenario places strong emphasis on managing the natural resources of the Tana Delta and Plan Area to much higher standards than are currently practiced, and this should improve the overall value of ecosystem services. However, the scenario also recognises that continued growth of population will increase pressures on the natural habitat and so it would be unrealistic to assume that yields and gross production can be significantly improved above present levels.

### 19.8.1 Non Timber Forest Products

#### 19.8.1.1 Area and Extent

As noted in the existing situation report and Scenario A, the land use zones from which most raw materials are harvested are forests, riverine forests, floodplain grassland and mangroves. These areas will be maintained at their present extent and therefore the same assumptions are relevant.

#### 19.8.1.2 Water Demand

Maintenance of the environmental reserve of 60m<sup>3</sup>/sec will provide the appropriate conditions for sustaining the habitats that are the principal sources of NTFP.

#### 19.8.1.3 Employment and Livelihoods

Harvesting of fruits, roots and tubers and medicinal plants would continue with around 5,000 collectors working full time in 2010 rising to 8,365 individuals by 2030. Thereafter the number would remain constant.

#### 19.8.1.4 Economic Value

The contribution to the local economy will be in the region of Ksh 80 million at 2002 prices rising to KSh 134 million in 2030 and KSh242 million in 2050.

### 19.8.2 Building Materials

#### 19.8.2.1 Area and Extent

In this scenario it is assumed that existing levels of exploitation for grass, reeds, palm leaves, timber poles and rope could be sustained in order to maintain the existing housing stock and to construct new houses in the remoter areas of the Tana Delta which are difficult, if not impossible, to reach by boat. However, the growth of population and rate of formation of new households would make continuing reliance on natural materials for the bulk of construction materials unrealistic in the long-term. Consequently, it is assumed that by 2030 only half of the new housing stock would be built of natural materials and this proportion would drop to around 10% by 2050. The need to import cement, concrete blocks, bricks, and roofing materials (zinc sheet and tiles) would represent a significant additional cost for households in the Tana Delta which could only be met through



**Table 19.20 Use of Natural Resources for Building Construction in 2010 and 2030**

Product	No of Households	Value (Million KSh)
New Building Construction	27,115	4,880
Clean technology cooking stoves	27,115	22.8
Solar installations	27,115	1,220

increased earnings from the sale of agricultural products and livestock or from direct employment.

One of the special characteristics of the Tana Delta is its cultural diversity, including the traditional styles of housing construction. In the interests of maintaining these traditions and also attracting income from tourism there would be a strong argument for identifying some of the existing communities in remoter areas of the Delta where incentives would be offered to maintain traditional life styles and customs, including building structures.

#### *19.8.2.2 Water Demand*

Maintenance of the environmental reserve of 60m<sup>3</sup>/sec will provide the appropriate conditions for sustaining the habitats that are the principal sources of natural building materials.

#### *19.8.2.3 Employment and Livelihoods*

In the period up to 2030 1,517 full time equivalent livelihoods would be provided each year in traditional house construction and repairs. Beyond that date numbers would progressively reduce to a minimum level of around 150 jobs a year by 2050.

#### *19.8.2.4 Economic Value*

The value of traditional construction would remain to that estimated for Scenario B, due to the need to conserve natural materials and resources beyond 2030. **Table 19.20** shows the value rising from KSh 100 million in 2010 to KSh 169 million in 2030 and KSh 305 million in 2050.

### **19.8.3 Charcoal and Fuel Wood**

#### *19.8.3.1 Area and Extent*

The current level of fuel wood extraction and timber exploitation for charcoal is close to, if not above, the sustainable yield from the remaining forests and thickets of the Plan Area. Consequently, the Land Use Plan needs to include an alternative strategy for providing heat and light to the Tana Delta communities. It is assumed that the current levels of fuel wood and charcoal extraction should not be exceeded by more than 10% and that

every effort should be made to introduce improved and alternative technologies. It is estimated that around 70km<sup>2</sup> of forest, woodland and thicket/scrub is used to harvest timber for firewood and charcoal. To meet pro-rata increase in demand in 2030 would require that this figure is raised to 123 km<sup>2</sup> which is completely unsustainable. Consequently, production of charcoal and firewood would need to be substantially reduced before 2030.

#### *19.8.3.2 Water Demand*

The continued growth in demand for charcoal and firewood would have an adverse effect on water uptake but could not be sustained in any event without damaging the biodiversity status of the Tana Delta. It is therefore assumed that production levels should taper off as soon as possible and the amount of charcoal and firewood harvested each year should decline rapidly.

#### *19.8.3.3 Employment and Livelihoods*

Under the strategy proposed in Scenario C, employment in charcoal and firewood manufacture should remain static at 4,971 FTEs and subsequently decline to less than half this figure by 2050.

#### *19.8.3.4 Economic Value*

Current production levels contribute in the region of KSh 195 million in 2010 and although further increase in production is inevitable until the point is reached that alternative technologies are adopted, the aim should be to maintain this level by increasing the amount of charcoal and firewood that is produced from sustainable (i.e managed) forest plantations in areas outside the most sensitive habitats.

### **19.8.4 Alternative Technologies**

As a first step, more fuel-efficient cooking stoves should be introduced to reduce the weight of charcoal needed for each firing. Then, the opportunities for alternative fuels including cooking gas and kerosene and rural electrification, using both conventional power and solar energy, should be targeted. The introduction of photovoltaic panels on the roofs of buildings could in itself create significant employment for new contractors.

**Table 19.21 Alternatives to Natural Resource Use in the period 2030-2050**

Product	No of Households	Value (Million KSh)
New Building Construction	27,115	4,880
Clean technology cooking stoves	27,115	22.8
Solar installations	27,115	1,220

For construction, the minimum cost<sup>10</sup> of providing low cost social housing of comparable size to Pokomo dwellings is in the region of KSh180,000 per unit, while alternative fuel prices are roughly double the cost of charcoal. Solar heating and electricity generation offers major opportunities for improving living conditions in the Tana Delta but at costs which cannot be considered at current income levels. A small solar photovoltaic system capable of lighting a house and powering one or two small appliances with a combined demand of 30-50 watts currently costs in the region of 300-500\$ (KSh 22-45,000) (Ikiara,2009). Costs have been falling steadily with increased demand and, in the timescale of the Plan, the scope for introducing rural electrification and independent solar systems will be very considerable.

## 19.9 Tourism

**Scenario C** incorporates and extends the ideas for tourism that were discussed in **Scenario B**. This includes the development of new hotels, camping sites and provision of ancillary restaurant and catering services.

### 19.9.1 Area and Extent

According to the Tana District Development Plan (2008-2012) there are currently six hotels within the Tana Delta. There are also a number of small establishments offering rooms with minimal facilities for overnight accommodation in Garsen and Witu. Cold and cooked food is sold by street traders and each town has a few small food outlets catering primarily for the local community. The catering, guesthouse and restaurant sector can be expected to grow with rising levels of commercial activity in each of the main centres and it is reasonable to expect that a good quality hotel will be established in Garsen and Witu, and possibly Tarasaa.

The Tana Delta offers major opportunities for developing eco-tourism based on its biodiversity and status as a Ramsar site. Bird watching, wildlife viewing and cultural tours would have international appeal. The most significant areas for eco-tourism would include, the coastline, the river network especially in the lower

reaches accessed from Kipini, Ozi Forest, other riverine forests and the Tana Primate National Reserve.

Two high quality tented and chalet camping sites could be accommodated, one within the lower Delta and the second in the Primate Reserve; each with 30-40 units providing 60-80 bed spaces.

### 19.9.2 Water Demand

Water consumption in catering and hotels can be significant but for the purposes of the Scenario assessment these activities are subsumed within the overall development of the urban areas.

### 19.9.3 Employment and Livelihoods

On the assumption that in the region of 200 livelihoods are supported at the present time by this sector, this number could double by 2030 to 400 and double again by 2050 to 800 full time jobs.

### 19.9.4 Economic Value

If it is assumed that three hotels are built with a total floor space of 36,000 m<sup>2</sup> and 6 quality restaurants covering 1,200m<sup>2</sup> the development cost at current prices would amount to around 2.23 billion KSh or 25.4 million USD. Development of two campsites could cost in the region of 50 million KSh or 570,000 USD.

A very rough assessment of annual turnover has been made by assuming 60% occupancy, the industry standard for viable operations (Odhengo *et al*, 2012a), with 120 bedspaces in tented accommodation and 300 bedspaces in hotels. Rates for tented and hotel accommodation have been assumed to be \$40 (KSh 3,360) and \$100 (KSh 8,500) respectively. The combined gross turnover amounts to KSh 640 million with an additional KSh 100 million for restaurant and catering enterprises.

## 19.10 Trade, Commerce and Financial Services

### 19.10.1 Wholesale and Retail

Wholesale, retail and the repair sectors are heavily

<sup>10</sup>Houses built under slum clearance and emergency relief schemes by charities like Habitat.

**Table 19.22 Contributions to the Local Economy of the Delta under Scenario C from Trade and Finance in KSh Millions**

Economic Sector	2010	2030	2050
Trade Wholesale and Retail	94	1834	3864
Financial Services	407	713	1503

dependent on the overall state of local and national economies since these goods and services are required by all other activities, like farming, livestock rearing, mining, transport, construction etc. Similarly the level of financial activity is related to the overall strength of the economy.

#### *19.10.1.1 Area and Extent*

The whole of the Delta Plan Area would benefit from an expansion in trade and financial services.

#### *19.10.1.2 Employment and Livelihoods*

There would be significant growth in employment in these two sectors.

#### *19.10.1.3 Water Demand*

Trade and finance would have only domestic scale demands for water and the figures are subsumed within general water consumption for the population as a whole.

#### *19.10.1.4 Economic Value*

Estimates of the value of trade which were generated for the Existing Situation and **Scenario A** would not be relevant to **Scenario C** which represents a hybrid between A and the more commercial model of future growth represented by Scenario B, since each commercial activity would generate significant trade in its own right and this in turn would lead to indirect growth in trade (the multiplier effect). For this reason the value of trade is modelled using the same percentage for this sector as occurs in the national economy (10.8%). Similarly, the contribution made by the financial sector is assessed at 4.2% (Mbuvi, 2004).

The value of trade is estimated at KSh 4,057 million in 2030 and KSh 8,647 million in 2050, while finance contributes KSh 1,578 million in 2030 and KSh 3,363 million in 2050 (see **Table 19.22**).

## **19.11 Mining and Quarrying**

### **19.11.1 Oil and Gas Exploration and Development**

#### *19.11.1.1 Area and Extent*

Under Scenario C it is assumed that large scale sand mining or other mining activities that would have a significant impact on the land surface of the Tana Delta,

would threaten the Tana Delta ecosystem and conflict strongly with the social, cultural and economic interests of the local communities. Such development would have large areas allocated to mineral prospectors as areas of search for minerals like oil and gas, and most of the Tana Delta is included within a prospecting licence area. Initial reconnaissance is undertaken using light aircraft (or vessels at sea) to carry out airborne remote sensing, or by seismic surveys on the ground. If interesting anomalies are identified in the underlying rock structures, which suggest the presence of oil and/or gas reservoirs, the next stage of exploration involves drilling one or more pilot boreholes. In many cases the borehole may penetrate rocks with the necessary characteristics to support oil and gas but the wells will be dry. If the presence of hydrocarbons is confirmed the borehole may be capped to allow subsequent re-entry to evaluate the find. The existence of oil and/or gas in underground deposits does not mean that exploitation will automatically follow. Samples of the oil/gas are taken for analysis and very detailed studies are required to model the three-dimensional characteristics of the 'oil/gas field' in order to determine how much exploitable gas or oil is present and whether it is of a suitable nature to extract using current technology. The search for oil and gas also extends out to sea, where geological conditions are thought to be similar to those off the Tanzanian and Mozambican coasts where large gas finds have been discovered in the last five years.

If, after exhaustive tests, a 'commercially viable' find is announced, the operating company will develop an extraction plan and programme, raise the necessary finance for developing the oil/gas field and apply for an extraction licence. Both stages of exploration and development should involve a full environmental and social assessment as part of the technical studies.

The amount of land required to position an exploration drilling rig is less than one hectare, although access is required for heavy equipment by road. Large parts of the Tana Delta would be inaccessible to drilling equipment unless it could be transported by barge or helicopter. However, access roads could be used to reach a sufficient number of locations for the necessary trials to take place in the event of a potential oil/gas discovery.

If oil and/or gas was found in exploitable quantities, the operating company would plan one or more permanent well sites from which the oil and/or gas could be extracted. This would entail drilling production wells and then connecting these to pipelines which would convey the crude hydrocarbon output to a site for onward shipment (by sea) or to a land-based processing plant. The logical destination of any oil or gas found in the Tana Delta would be the proposed oil refinery to be built as part of the LAPSET project.

#### 19.11.1.2 Water Demand

In the exploration stage water is used as a medium to carry drilling mud to the base of any borehole as a lubricant, to reduce the temperature of the drill bit and to flush out rock particles and carry these back to the surface. Use of water needs to be carefully controlled to avoid environmental damage from the dispersal of wastes and drilling mud. In the operating phase, water is sometimes used to pressurise an underground reservoir and effectively force oil and gas which is trapped in the rock into the well and back to the surface.

Only a small amount of water is used in the exploration phases whereas large quantities can be required to support production.

#### 19.11.1.3 Employment and Livelihoods

Most operations associated with oil and gas exploration and development are very technical and require highly skilled and experienced workers. As a consequence, most jobs can only be filled by external experts. However, in the development phase, a large support team is needed including drivers, labourers, road builders, pipeline welders, engineers and mechanics. Fewer than fifty workers are required during exploration and perhaps 200-300 during the development phase, reducing to fewer than fifty again, once full production has commenced.

#### 19.11.1.4 Economic Value

The cost of sinking an individual borehole can easily exceed USD 50 million and development of a substantial oil/gas field may run into billions of dollars. Consequently, an oil and/or gas project would only proceed in the Tana Delta if the economic returns were similarly large. Experience elsewhere, including the new Turkana field in Kenya and the Albertine Rift finds in Uganda highlight the need to plan for significant benefits to flow to local communities in the affected areas as well as to the national exchequer and this will be a key concern for both County Governments if oil and gas is eventually found in the Tana Delta area.

**Table 19.23 Potential Oil and Gas Development in the Tana Delta**

<b>Exploration Phase</b>	<b>Requirements</b>
Area required for drilling	1-5 hectares
Water requirements	Low (under 1 million m <sup>3</sup> )
Employment / Livelihoods	10-50 workers
Value	USD 1 -20 million
<b>Development Phase</b>	
Area required for drilling, pipelines, storage yards, access	50-200 hectares
Water requirements	Unknown (potentially large)
Employment / Livelihoods	200-300 workers during construction. Under 50 workers during production
Value	Multi-million dollar investment

## 19.11.2 Heavy Mineral Sand Mining

### 19.11.2.1 Area and Extent

The Tana Delta sand dunes have been identified as a promising location for finding commercially viable quantities of heavy mineral sands, comprising rutile, ilmenite and zircon. Similar deposits exist along the Somali coastline and in Kwale County (the most southerly on the coast). There are many serious reservations about working mineral sands in the Delta because of the damage that would result to the Ramsar site. Nevertheless the details of comparable operations are given here in order to allow an assessment of costs and benefits to be made.

A titanium mine has been opened in Kwale County with the first shipment of minerals taking place in 2013. The Kwale mine expects to produce 440,000 tonnes of ilmenite, rutile and zircon over a period of 13 years. The extracted concentrate is shipped from a purpose built coastal jetty taking large tankers to overseas refineries (principally in Australia) (Moolman, 2013). Over \$300 million in taxes and royalties will be generated for Kenya over the mine's life. (Mining Weekly Sept, 2013). The deposit has been quoted as holding 3.1 billion tonnes of high grade (3%) heavy minerals.

Ore concentrations are usually closer to 1% of the total volume of sand that must be excavated, so a development exporting 400,000 tonnes of concentrate a year would involve mining in excess of 40 million tonnes of sand a year, equivalent to an area of 200 hectares from a sand dune with an average height of twenty metres.

Two methods of extraction are typically used. If the ore deposit is above the water table large earthmoving

excavators and dump trucks or mobile conveyors are used to transfer the sand to a processing plant. Alternatively, if the deposit lies below the water table a large lagoon is excavated in order to allow a massive floating dredger to be introduced. Sand is then dredged and pumped through pipelines to the processing plant. Regardless of the method of extraction, the separation of heavy minerals from low grade 'worthless' sand is undertaken using centrifuges, filters, electrostatic or chemical means. The concentrated ore is dried and exported while sludge and slime residues are pumped to settling lagoons or released in open water. Bulk sand is usually returned to the site of excavation to allow rehabilitation to take place.

All of these processes have varying degrees of adverse environmental impact.

### 19.11.2.2 Water Demand

Large amounts of water are needed at all stages of extraction and processing. A particular challenge on the Kenyan coast is the potential for disruption of recharge, or saline contamination of existing sand dune aquifers.

### 19.11.2.3 Employment and Livelihoods

Large scale extraction processes of this nature will typically require a labour force of 100-200.

### 19.11.2.4 Economic Value

The average value of the three main products is around \$400/ tonne, giving a gross turnover of USD 176 million a year.

**Table 19.24 Typical Heavy Mineral Sands Mining Operation**

Phase of Operation	Requirements
Area of land taken each year	200 hectares
Excavation of sand each year	40 million tonnes
Annual reinstatement	200 hectares / 39 million tonnes sand
Disposal of slimes / silt each year	1 million tonnes
Use of water	In excess of 40 million m <sup>3</sup>
Number of Employees	250
Annual Turnover	USD 176 million



### 19.11.3 Manufacturing

The assumptions made about manufacturing and industrial development under Scenario B have been incorporated without change in Scenario C, since they represent the most cost-effective and environmentally sustainable way of providing employment and livelihoods for the Tana Delta's growing population. Development would be focused on the industrial sites in Garsen, Witu and Tarasaa, with a specialist centre in Kipini concentrating on fish and fruit processing. Fish, meat, dairy and natural raw material processing could be developed as a specific 'cluster' activity and given a strong marketing identity under a collective Tana Delta brand name.

The range of activities listed in the ISIC is shown below.

#### Section C Manufacturing

- Processing and preserving of meat
- Processing and preserving of fish, crustaceans and mollusks
- Processing and preserving of fruit and vegetables
- Manufacture of vegetable and animal oils and fats
- Manufacture of dairy products
- Manufacture of soft drinks; production of mineral waters and other bottled waters
- Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
- Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
- Manufacture of pharmaceuticals, medicinal chemical and botanical products

#### 19.11.3.1 Area and Extent

As in the case of Scenario B this scenario considers the possibility of establishing three industrial parks, with a main centre at Garsen and two subsidiary sites in Witu and Tarasaa. However, an additional industrial site is also provided at Kipini. The Garsen Industrial Centre would

occupy 60 hectares and those at Witu and Tarasaa 30 hectares each, with a 10 hectare site developed at Kipini.

It is assumed that 30% of each site would be developed as factories with the remaining 70% allocated to external storage, circulation and other infrastructure (electricity sub-station/transformer; water treatment plant; etc.). On this basis the Garsen site would offer the potential of 180,000 m<sup>2</sup> (1.9 million sq feet) of factory/warehousing space. There would be 90,000 m<sup>2</sup> building development in both Witu and Tarasaa, and 30,000 m<sup>2</sup> in Kipini. Over the next fifteen years to 2030 it is assumed that half the total area of the available development sites might be taken up with the balance being constructed by 2050 to give 390,000 m<sup>2</sup> in total.

#### 19.11.3.2 Water Demand

Under **Scenario C** it is assumed that 16 factories are established in total within the 4 industrial parks, specialising in meat processing (2), fish processing (2), fruit and vegetable processing (4), manufacture of animal and vegetable fats (1), dairy products (2), soft drinks and water (1), tanning and leather working (1), bamboo and plaited materials (2) and botanical products (1).

Total annual consumption from the twelve plants would amount to around 200 million m<sup>3</sup>. Of this a significant proportion would be discharged as waste water and could be returned to local water courses, subject to proper treatment. Actual consumption would be in the region of 20 million m<sup>3</sup>.

#### 19.11.3.3 Employment and Livelihoods

Individual factories could be expected to begin operations with 5-15 employees increasing as the businesses became more profitable and expanded. Using the assumption that one job is created for every 50m<sup>2</sup> of floor space the 90,000m<sup>2</sup> capacity of the potential buildings could support 7,800 workers.

**Table 19.25 Development of Industrial Estates**

Location	Site Area (ha)	30% building development (ha)	floorspace (m2)	Jobs (1:50M <sup>2</sup> )
Garsen	60	18	180,000	3600
Witu	30	9	90,000	1800
Tarasaa	30	9	90,000	1800
Kipini	10	3	30,000	600
<b>Totals</b>	<b>130</b>	<b>39</b>	<b>390,000</b>	<b>7800</b>

#### 19.11.3.4 Economic Value

Development costs<sup>11</sup> in Kenya currently range from 20,000-60,000 KSh per square metre and factory/warehousing is at the lower end, although significant additional costs would be incurred in providing road access and services to the proposed business parks. Allowing for full development and equipment of individual factories a figure of 25,000 Ksh is allowed for the six units developed by 2030, amounting to a gross capital investment of 4 billion Kenyan Shillings (45.6 million USD).

## 19.12 Infrastructure

Significant development of infrastructure would take place under the hybrid development **Scenario C** in order to support commercial farming and livestock rearing and the creation of new industrial estates. Road building would be most important but potable water supplies and untreated water for irrigation would also require pipeline (and/or canal) construction.

### 19.12.1 Construction

The same assumptions on construction activity are applied in **Scenario C** as were developed for **Scenario B**.

#### 19.12.1.1 Area and Extent

Over the 40 year period covered by **Scenario C** there would be significant new development, including the industrial parks, but also public institutions (schools, hospitals, administration centres) local feeder roads and individual houses. A nominal area of 1,000 hectares is assumed for urban development. This analysis excludes the level of site preparation, land levelling or construction of canals and embankments that would be required for irrigation schemes which is assessed within those individual projects.

#### 19.12.1.2 Water Demand

Construction work requires water for site preparation, concreting and block making but these are short-term demands and do not impose a significant load on available

water resources. A nominal amount of 50,000m<sup>3</sup> per annum is assumed equating to 140m<sup>3</sup>/day.

#### 19.12.1.3 Employment and Livelihoods

Construction is an important source of short term and temporary employment with both men and women being employed as labourers for site development and road construction projects. Where there is continuity of projects over a number of years some labourers will acquire specialist experience and with appropriate education and training, they will advance to positions of foremen and supervisors. It is assumed that in the region of 200-300 full time equivalent jobs will be provided annually in the Plan area.

#### 19.12.1.4 Economic Value

Construction is treated as an economic indicator in its own right when assessing a country's economic performance and typically lies in the range of 4-8% of gross value of GDP. No data is available on current construction costs in the Delta but a study by the World Bank in 2000 provides cost estimates based on a survey of 93 projects constructed between 1995-1999 (Turner & Townsend, 2012). Tarred roads in Kenya typically cost in excess of USD 600,000 per kilometre whereas gravel roads cost around USD 60,000 (Sogomo, 2010).

**Table 19.26** sets out some typical costs for road work. It is assumed that 2 kilometres of new feeder road will be built each year and ten kilometres of existing gravel road will be rehabilitated.

## 19.13 Transport

The same assumptions are employed for **Scenario C**, as were developed for **Scenario B**.

### 19.13.1 Area and Extent

Local transport by road and water plays a vital part in maintaining livelihoods and the economy of the Tana Delta. Canoes are used for both passenger and freight transport and every riverside village supports a number of boatmen with their own canoes. Pickup trucks and

**Table 19.26 Indicative Costs for Construction and Repair of Roads in the Delta (2010 Prices)**

Nature of work	2010 – 2030 (Annual work load)		2030-2050 (Annual work load)	
	Length	Cost (USD)	Length	Cost (USD)
New Road Construction	2	120,000	2	120,000
Existing road rehabilitation	10	60,000	20	120,000
<b>Total</b>		<b>180,000</b>		<b>240,000</b>

<sup>11</sup>Cost of building in Kenya April 19, 2012 Business Construction News

small lorries are used for moving larger freight by road, but much of the area can only be accessed on unsurfaced roads by bicycle or motorbike. Over the course of the plan period there would be a significant road construction programme, providing surfaced feeder roads to all main settlements.

### 19.13.2 Water Demand

Water plays a key role in supporting transport and can at times cause serious disruption through flooding of roads and physical damage to infrastructure. However water use is minimal.

### 19.13.3 Employment and Livelihoods

Transportation is an important source of livelihoods and employment, especially for males and youths. The majority of the population will use local transport at one time or other. As a very rough estimate it is assumed that between 500-1,000 people may be engaged as drivers, hauliers or couriers in a typical day.

### 19.13.4 Economic Value

Transportation, like construction is an important component of both local and national economies since the marketing of goods and delivery of supplies and provisions would be impossible without it. No estimates currently exist for the value of transportation within the Tana Delta. However, by applying the pro-rata figure that relates to the role of transport in the national economy (12.4%) it is possible to provide an indication of gross value. The figures calculated for the delta are KSh 2,106 million in 2030 and KSh 4,437 million in 2050.

## 19.14 Administration, Professional Services, Education and Health

### 19.14.1 Public Administration

Kenya has experienced rising costs of public administration, due partly to the increased expenditure on establishing new County Governments to replace the former provincial administration. It will take time to stabilise the level of administration costs but eventually

administrative services can be expected to expand in relation to the size of population in any given area. **Scenario C** anticipates significant economic growth within the Tana Delta and this will require strengthening of the existing administrative services to be paid for largely from increased turnover.

### 19.14.2 Professional Services

Widening and diversification of the economic sectors in the Tana Delta will only be achieved if the levels of entrepreneurial activity increase with an increasing number of professional workers in consultancy, finance, marketing, and related fields to support and train the new workforce. This sector is therefore expected to grow strongly under **Scenario C**.

### 19.14.3 Education and Health

These sectors of the local economy can be expected to grow in line with national forecasts and are a vital part of building and strengthening the future of the Tana Delta.

### 19.14.4 Economic Valuation

No information is held on the level of employment in these service sectors of the economy although it would be reasonable to expect that national averages should apply if the Tana Delta starts to develop strongly. In order to include a realistic estimate of the importance of these sectors in the economic evaluation, the respective figures have been employed from 2012 data on Gross Domestic Product from the National Accounts. Public administration, education and health contribute 11.1% of the national economy and the equivalent percentage for Tana Delta gives figures of KSh 1,885million in 2030 and KSh 3,972 million in 2050.

## 19.15 Urban Areas

Urban development is added to this analysis of economic activities because although it does not appear in the International Standard Industrial Classification, it forms a vital component in the overall assessment of land use change under the three scenarios.

**Table 19.27 Growth of Urban and Rural Settlements**

Development Component	2010 (Ha)	2010-2030 (Ha)	2030-2050 (Ha)	Total area in 2050 (Ha)
Residential Property	2,620	839	1,515	4,974
Commercial and Industrial	0	1,678	3,030	4,708
<b>Total</b>	<b>2,620</b>	<b>2,517</b>	<b>4,545</b>	<b>9,682</b>

### 19.15.1 Area and Extent

Based on the figures for population growth it is possible to estimate the number of new houses that will be required and the amount of land needed to accommodate residential buildings, schools, clinics, wells, shops, mosques and churches and other essential features of human settlement. A major issue for local communities in the years ahead will be the process of balancing the desire to maintain cultural traditions, including the nature of houses, use of livestock corrals and the layout of individual settlements and public streets against the attractions and convenience of using modern building materials including zinc for roofs and bricks and concrete in place of grass, mud and thatch.

Such issues will be for each community to resolve and there is no intention to impose standards through the Land Use Plan, but at the same time it is helpful to anticipate the maximum requirement for building land and public open space within each settlement. For this reason the assumption has been made that 50m<sup>2</sup> of building land should be available for family groups of 7 people with a further 200 m<sup>2</sup> for external living space, totalling 250m<sup>2</sup> (equating to 16 dwellings per acre; 40 per hectare). The area added for community use, public open space and roads/paths should match the total allocated to individual use; so a settlement of 5 houses (occupying 1,250m<sup>2</sup>) would require an additional area of 1,250m<sup>2</sup> bringing the total to 2,500m<sup>2</sup>. These estimates relate to the development of rural settlements.

In the case of the larger urban settlements, a greater area of land will be required for laying out communal, industrial, commercial and shopping areas and for providing the necessary road network. This is likely to be double the land area required for residential use. Using these figures, the growth of population by 60,000 by 2030 would require a total of 839 hectares for residential development, with a further 1,515 hectares by 2050. The equivalent increase in the urban footprint to meet communal, industrial, commercial and shopping activities would be 1,678 ha by 2030 and a further 3,030 ha by 2050.

## 19.16 Water Resources

### 19.16.1 Water Consumption

Water consumption will increase with rising population and the increase in farming and livestock rearing. The use of water is accounted for under each type of economic or livelihoods activity. There is therefore no separate breakdown of information under area and demand or employment. However, it is important to note that water has a real value, whether it is paid for as supplied by a public utility or received as a free good as rain or collected from a river. For this reason, the value of water is calculated in these scenarios at the same rate at which is charged to communities who rely on kiosks and standpipes which is KSh 100 per 1000 litres (1m<sup>3</sup>).

**Domestic Consumption:** The current low level of domestic water consumption, assumed to be 20 litres per head, (Mati, 2006) should rise on humanitarian grounds to a minimum of 40 litres per head by 2030 and to double this amount by 2050 (i.e 80 litres/ head) (See **Table 19.28**). This is still only half the current per capita consumption in the major urban centres of Nairobi and Mombasa.

**Livestock watering** will also add to overall water consumption, as shown in **Table 19.29** Water consumption by Zebu cattle equates to 12-20 litres/head/day (FAO,2004) while sheep and goats consume one tenth of this amount.

**Farming and Irrigation:** The expansion of subsistence and community farming areas will result in additional pumped and gravity irrigation schemes and create a demand for 48.7 million m<sup>3</sup> in 2030, rising to a total of 75.7 million m<sup>3</sup> by 2050. See **Table 19.30**.

Total water consumption for all demands except the environmental reserve is shown in **Table 19.31**.

The equivalent flow rates to support this level of water abstraction are shown in **Table 19.32**.

**Table 19.28 Domestic Water Consumption**

Population	2010	2030	2050
Total	102,000	174,000	315,000
Water Consumption (M <sup>3</sup> /day)	2,040	6,960	25,200
Annual Water Consumption (Million m <sup>3</sup> )	0.7	2.5	9.2
Value in KSh per year (KSh 100/m <sup>3</sup> )	74,460,000	254,040,000	919,800,000

**Table 19.29 Livestock Water Consumption**

<b>All livestock</b>	<b>2010</b>	<b>2030</b>	<b>2050</b>
Daily demand (m <sup>3</sup> )	4,240	3,000	3,000
Annual Demand (Million m <sup>3</sup> )	1.548	1.095	1.095

**Table 19.30 Water Demands for Farming and Irrigation**

<b>Type of Farming</b>	<b>2010</b>	<b>2030</b>	<b>2050</b>
Subsistence cultivation	183	309	557
Commercial /Irrigated	20	84	269
<b>Total</b>	<b>203</b>	<b>393</b>	<b>826</b>

**Table 19.31 Daily Demand for Water in 2010, 2030 and 2050**

<b>Water Demand</b>	<b>2010</b>	<b>2030</b>	<b>2050</b>
Domestic	2,040	6,960	25,200
Livestock	4,240	3,000	3,000
Irrigation	10,548	133,424	207,397
Total M <sup>3</sup> /day	16,828	143,384	235,597
Value KSh (Millions/year)	6.1	52.3	86.0

**Table 19.32 Effect of Abstraction on Tana River Flows**

<b>Water Demand</b>	<b>2010</b>	<b>2030</b>	<b>2050</b>
<b>M3/sec</b>	<b>0.19</b>	<b>1.54</b>	<b>2.40</b>

### 19.16.2 Water Sources

Water consumption for all forms of abstraction begins to make an appreciable impact on available river flow by 2030 (taking 0.8% in 2030 and 1.8% in 2050). However direct abstraction is far less significant than the requirement which would exist to provide sufficient water to maintain grassland and rangeland in a condition capable of sustaining the massive increase in stocking density. This is assessed separately in the Tana River Delta SEA report (Odhengo *et al*, 2014a). However, as described under the existing situation section most of the water which flows through the Idsowe Bridge is required to maintain the natural vegetation and grasslands of the Tana Delta during the dry season and any decrease in natural river flows below a monthly average of sixty cubic metres of water per second (60m<sup>3</sup>/sec) as a result of development upstream would rapidly affect the capacity of the system to maintain the livelihoods and biodiversity of the Delta. This figure of 60m<sup>3</sup>/second is referred to as the environmental reserve.

### 19.17 Nature Conservation

This section considers both the opportunities created for sustainable development through management and wise use of the natural assets of the Delta and the challenges that would remain in terms of protecting of biodiversity.

#### 19.17.1 Opportunities for Sustainable Development

##### 19.17.1.1 Area and Extent

This scenario focuses on opportunities for commercial development and while nature conservation, the arts, entertainment and recreation are often thought of as public services there are a growing number of examples of conservation and cultural projects that are self-financing and highly profitable for their sponsors (whether private sector or communally owned). Countries like South African and Botswana have many commercial and profitable game reserves but Kenya itself has been a trend setter in demonstrating the



opportunities for community groups to set up tourism and game management projects, especially in the Maasai Mara. Other significant community based projects have included the work of the Northern Rangelands Trust, which is an amalgam of more than ten Community Conservancies, including Ndera Conservancy in the Upper Delta. Serious game management requires major investment, including extensive fencing of the reserve perimeter and the development of lodges and trails for 4x4 vehicles.

In the Tana Delta there are major opportunities for exploiting the existing natural flora and fauna, with boat rides into the core of the wetlands and walking/driving trails within the Primate Reserve but these activities appeal to quite a narrow sector of the wildlife tourism market and it would be necessary to broaden the appeal by developing other attractions, e.g. butterfly centres, canopy level walkways through riverine forest and cultural events within traditional village settings. Nature Kenya, as an 'extraterritorial organisation', has spearheaded development of livelihoods within six villages in the Delta over the last four years and is committed to continuing its association in the years ahead in order to strengthen the conservation of this unique series of habitats and communities. Other conservation initiatives share the same aims.

The areas which form the principal existing attractions are the primate reserve (17,000 hectares) and the core area of the Delta (70,000 hectares).

#### *19.17.1.2 Water Demand*

The primary requirement to meet nature conservation needs is sufficient water to maintain the existing mosaic of habitats comprising river channels, forests, riverine forests, palm savannah, open water, wet grassland, marshes and mangrove forests. No detailed study has been undertaken to confirm the full requirements of these complex ecosystems, but the Tana River Delta SEA has confirmed, contrary to previous assumptions, that the River Tana has historically maintained a mean monthly flow of not less than 50m<sup>3</sup>/sec below Garsen (Idsowe Bridge) except in very dry periods lasting 3-4 months in exceptional drought years (Odhengo *et al*, 2014a). Twice yearly flooding is also a critical event for maintaining the delta habitats and a preliminary estimate has been made in relation to the feasibility study for the High Grand Falls Dam that 0.8 billion m<sup>3</sup> of water should be released annually in two events of 400 million m<sup>3</sup> over ten days to simulate the effect of the annual floods that will be disrupted by constructing the dam (Egis Bceom International, 2011).

#### *19.17.1.3 Employment and Livelihoods*

Nature conservation is a large untapped market which offers major opportunities for enhanced and new livelihoods in managing the natural habitat, wardening its precious wildlife reserves and harvesting natural produce. If every village community were to nominate 5 people to work full time on conservation activities this would offer a labour force of almost 500. In practice it is likely that the majority of residents will commit part of their time to nature conservation while undertaking other traditional livelihood practices.

#### *19.17.1.4 Economic Value*

In many countries the natural environment, landscapes and natural resources (like beaches, rivers, waterfalls and mountains) form the main attraction for eco-tourism, sports and recreational tourism. Kenya benefits more than most from its fauna and flora, linked with the scenery and cultural assets of its national parks. Kenya is also a leader in developing innovative ways of exploiting natural assets to generate livelihoods and income for its local communities. The Northern Rangeland Trust (NRT) is one example of an umbrella organisation which promotes tourism and economic activity based on the conservation values of its community conservancies and the Tana Delta has followed a similar approach, albeit on a much smaller scale.

In the NRT individual community conservancies earn money from a variety of enterprises including guided tourism, managing tourism camps, and handiwork manufacture. The Sera Project in Samburu East, with a population of 8,000, operates with a budget of USD 110,000 per annum (Laikipia Wildlife Forum, 2012). In comparison, West Gate Community Conservancy, with 3,500 people to support, has a budget of USD 75,000 per year (Laikipia Wildlife Forum, 2012). This conservancy has leased out its tourism potential to a private company (Tamimi Co Ltd) which promotes an 18 bed luxury tented camp opened in 2007. A number of conservancy members are directly employed and a proportion of revenue is allocated to the conservancy (Laikipia Wildlife Forum, 2012). Income projections for an equivalent project sponsored by the African Wildlife Foundation on community ranches on the edge of Amboseli National Park show annual returns of USD 42,000 on a ranch owned by the 248 adult members of eight families, equating to an annual income of USD 165 per adult (Kiyiapi, *et al*, 2005).

It is assumed that two or three conservancies could be established for the Tana Delta, covering the coast, lower floodplain and upper floodplain, although detailed negotiations would be required with the existing

community groups including the Lower Tana Delta Conservation Trust, to reach agreement on the areas, structure and organisation. Using the models described above, the aim would be to encourage all villages to join an umbrella Tana Delta Trust with three associated community conservancies.

Over the Land Use Plan period, three tourism lodges might be built with 25 bed spaces each generating \$40,000 a year. The target for annual Income under the Tana Delta Trust would be USD 200,000 per annum, with USD 120,000 being generated by the trading activities of each of the three conservancies and the balance of USD 80,000 being attracted through International sponsorship. Other income-generating activities to be pursued by the Tana Delta Trust might include establishment of a local security business, the Tana Delta Scouts, which would safeguard communal interests and provide support to KWS in patrolling and monitoring wildlife and preventing poaching. A further area of conservation activity could be linked to safeguarding existing forest resources under a Carbon Credits initiative.

### 19.17.2 Challenges

**Scenario C** presents an optimistic view of future land use change and management within the Tana Delta over the next forty years and if all the measures recommended in the Land Use Plan and SEA are put into effect, the overall health of the Delta's ecosystems could be better than it is today. However, it would be easy to overstate the opportunities and ignore the very formidable challenges which stand in the way of achieving this goal. The main threats to continued good health of the Tana Delta wetlands are:

1. Population growth – unless the rate of inward migration and natural increase are brought under control by 2030 there is no prospect of delivering the objectives of **Scenario C**.
2. Water Resource Management in the Upper Tana Basin will have to be greatly improved in order to ensure that the minimum environmental flows reach the Tana Delta. National level decisions that have been taken in recent years on expansion of irrigation and development of hydro-power do not give any degree of confidence that a sustainable balance will be achieved by 2030.
3. Resource Use Conflicts – are largely based on competition for land and water and will increase unless the first two challenges are effectively addressed. However, beyond the impact of external decisions on the Delta, there is now the need to develop detailed internal land-use plans to give effect to a preferred strategy based on **Scenario C**. The question that has to be answered is: will there be a sufficiently strong consensus amongst the communities and the required level of leadership from both County and National governments to overcome the tensions that still exist?

Providing the challenges outlined above are dealt with effectively **Scenario C** offers a way forward that should safeguard the integrity and biodiversity of the Tana Delta for the next forty years.

### 19.18 Summary

**Table 19.33** provides an overall summary of **Scenario C**, which can be compared with the data given in the existing situation analysis.

**Table 19.33 Summary of Scenario C**

Component	Measure/Unit	2010	2030	2050
Population	Thousands	102	175	315
Workforce	Thousands	52	87	158
Urban Area	Km <sup>2</sup>	26.2	51.4	96.8
Industrial land	Hectares	10	70	130
Open Grazing	Area occupied	112,800	25000	25,000
	Cattle - Maximum number	735,000	600,000	600,000
	Cattle - Minimum number	220,000	50000	50,000
	Cattle - Average number	477.5	325,000	325,000
	Value Minimum (KSh 12,000/head) KSh million	2,640	600	600
Ranches (Delta)	Area occupied (Ha)	9200	40000	40,000
	Cattle - Maximum number	480	100,000	100,000
	Cattle- Minimum number	480	100,000	100,000
	Cattle - Average number	480	100,000	100,000
	Average value (KSh Million) @ 17,500/ head	8.4	1,750	1,750
Farming	Subsistence (Area Km <sup>2</sup> )	62	201	250
	Subsistence (people supported '000s)	51	87	158
	Value of subsistence crops (KSh million)	183	309	557
	Irrigated land (Ha)	385	9100	9100
	Labourers all communal/commercial farming	12.4	12250	12250
	Communal farmland (Km <sup>2</sup> )	4.5	300	650
	Rain fed agriculture (KSh million)	0	2092	4166
Fishing	'000Kgs/annum	613	750	1025
	Value (KSh million)	53	65.3	89.2
Fish farming	Tonnes/annum	0	1272	2544
	Value (KSh million)	0	44.5	89
Bee keeping	Number of hives	12,150	24,000	36,000
	Honey (000 Kg)	82	240	360
	Value (KSh million)	25	72	180
Natural Products	Area for required for harvesting (Km <sup>2</sup> )	70	123	123
	People engaged	4971	8365	8365
	Income generated from NTFP (KSh million)	80	134	134
	Value of traditional building (KSh million)	325	325	325
	Charcoal / Firewood - average ('000 tonnes)	58.7	58.7	58.7
	Value of Charcoal and Firewood (KSh million)	194	194	194
New building	Value with new materials (KSh million)	0	244	244
New technology	Annual value of cooking stoves / solar	0	62	62
Tourism	Turnover (Value '000USD) (KSh million)	26 (2.2)	178 (15)	440 (37)
Trade & Finance	Value million USD (KSh million)	0.6 (501)	3 (2547)	6.4(5367)
Mining	Area Involved	0.5	0.5	0.5
Salt only- No Oil	Turnover KSh million	257	257	257
Industry	Capital investment million USD (KSh million)	0	0.5 (45.6)	0.5 (45.6)
Road Construction	Capital investment '000 USD (KSh million)	0	180 (51)	240 (20)
Water Demand	All uses except reserve M <sup>3</sup> /day	16828	143,384	235,597
	Value KSh (Millions)	6.1	52.3	86.0
Biodiversity	Plant uptake (m <sup>3</sup> /day)	10,548	27,397	54,795

# APPENDIX

## **APPENDIX 1: REVIEW OF NATIONAL POLICIES AND INTERNATIONAL CONVENTIONS**

The SEA and LUP principles are both formulated around international standards, national legislation and government policy. A review of Kenya policies and legislation does show that there is an enabling policy and legislative framework to guide participatory natural resources management in Kenya. All the policies including the Kenya Constitution 2010 and the National Land Policy 2009, contain provisions sufficient to ensure sustainable land production principles, and sustainable conservation of land ensuring quality, environmental audit and assessment, productivity targets and guidelines as contained in EMCA and involving local communities in the joint management of forestry natural resources as contained in the Forests Act 2005. This chapter summarises some of the key environmental acts and policies in Kenya. In addition some relevant intergovernmental agreements have been highlighted.

### **Kenya Constitution, 2010**

The Constitutional dispensation of Kenya (2010) recognizes Environment as a critical and integral part in achieving sustainable development. Article 60 of the Kenya Constitution sets out the principles on which land shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable. Article 66(1) empowers the state to regulate the use of land in the interest of defence, public safety, public order, public morality, public health, or land use planning.

Article 67(1)(h) provides for establishment of the National Land Commission which will be in charge of monitoring and have oversight responsibilities over land use planning throughout the country. Article 69 gives the state power to ensure sustainable exploitation, utilization and management of natural resources.

Article 42 of the bill of right provides that every person has the right to a clean and healthy environment giving prominence to the environment not as a state-given resource but rather God-given. Article 70(1) further empowers any citizen who alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be, denied, violated, infringed or threatened to apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter.

Chapter 5 of the constitution details the two interconnected issues of land and the environment; while part 1 of this chapter tackles land, the latter details the obligations in respect to the environment, enforcement of environmental rights (article 70) as well as agreements

relating to natural resources and legislation relating to the environment in article 71 and 72 respectively. The law therefore underscores the need for sustainable utilization, exploitation, management and conservation of the environment and natural resources as well as ensuring ecologically sustainable development and the protection of ecologically sensitive areas such as Tana Delta wetlands.

### **Acts of Parliament**

Land use planning and management is elaborately covered in a number of Acts of Parliament such as the Land Act of 2012, Land Registration Act (2012), National Land Commission Act of 2012, County Government Act of 2012, Urban Areas and Cities Act of 2011, Physical Planning Act (2012), Environmental Management and Coordination Act of 1999, Water Act of 2002, The Wildlife Conservation and Management Act, 2013, Agriculture, Fisheries and Food Authority Act, 2013, Forests Act of 2005, the County Governments (Amendment) Act, 2013, Intergovernmental Relations Act of 2012, Transition to Devolved Government Act of 2012 among others.

**The Land Act, 2012** is an Act of Parliament that gives effect to Article 68 of the Constitution; to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources. Article 4(1) of the Act outlines the guiding values and principles of land management and administration.

**The National Land Commission Act, 2012** provides for establishment of the National Land Commission which shall have among other core functions, the role of facilitating the linkage between the Commission, county governments and other institutions dealing with land and land related resources. The Act is in tandem with Article 67(1)(h) of the Constitution which provides for the establishment of the National Land Commission.

**The County Governments (Amendment) Act, 2013** tasks the county governments to prepare county plans. Article 102(1) of the Act empowers the County Government to plan for the county and further states that no public funds shall be appropriated outside a planning framework developed by the County Executive Committee and approved by the County Assembly. The county planning framework shall integrate economic, physical, social, environmental and spatial planning.

**The Physical Planning Act (2012)** mandates the Director of Planning to prepare various types of physical development plans (regional and local) which provide the physical development framework for affected areas. Section 29 of the Act empowers Local Authorities to



prohibit or control the use and development of land and buildings in the interest of proper and orderly development of an area. Section 36 stipulates the requirement for conducting of an Environmental Impact Assessment for any development that is likely to have injurious effects to the environment or is particularly large in scale.

**The Urban Areas and Cities Act, No. 13 of 2011** provides for the classification, governance and management of urban areas or cities. Clause 5.1 of the Act provides for the classification and establishment of Urban Areas and Cities. Clause 36 stipulates that, every city and municipality shall operate within the framework of integrated development planning which, among other responsibilities, shall be the basis for development control and a county government shall initiate an urban planning process for every settlement with a population of at least two thousand residents. The preparation of the integrated urban area or city development plan for a city or urban area shall provide for linkage, integration and coordination of sector plans and development control.

**The Forests Act, 2005** provides for the preservation and sustainable use of forest resources. The Kenya Forest Service is the overall institution responsible for conservation and protection of forests and local Community Forest Associations assist in management. The Forests Act (2005) objectives include: the establishment, development and sustainable management, conservation and rational utilization of natural resources for the socio-economic development of the country for poverty reduction, employment creation and improvement of livelihoods within a framework where private sector, local communities and civil society institutions and other stakeholders have a role to conserve water catchment areas, create employment, reduce poverty and ensure the sustainability of wildlife and the forest sector. The Forests Act (2005), emphasizes participatory forest management mechanisms with Section 46(1) allowing the establishment of Community Forest Associations (CFAs) and Sub-section (2) allowing established associations to apply to the Kenya Forest Service Director for permission to participate in the conservation and management of a state forest or local authority forest.

**The Water Act, 2002** has provisions for sustainable water management. The Water Act 2002, is ideal for catchment protection and protection of wetlands and wells and springs that supports community involvement in management of these areas. Section 71(1) of the Water Act, 2002 requires licensed water users to enter into agreements for catchment protection, drainage of land, carrying out soil conservation measures or

control of vegetation or effectively preserving purity and quantity of water. The Act establishes several institutions to conserve and manage water resources in Kenya and allows community participation in supply and conservation of water resources. The institutions include Water Resources Management Authority (WRMA), Water Resource Users Associations (WRUAs) and Water services boards and companies. The Act further declares the pollution of a water source as an offence. The Act defines water reserve as the amount of water that must be retained in the environment to guarantee sustainability of water supply for proper ecological and biophysical functions. In view of various irrigation projects proposed in the Delta it is important to determine the water reserve in the Tana basin. This will help in determining the amount of water available for irrigation, livestock, industrial and domestic uses. This will assist in rationalizing water resource use in the basin.

**The Intergovernmental Relations Act, 2012** provides a framework for consultations between the National and County governments, among county governments and a mechanism of resolving disputes. The Act provides a mechanism for transferring or delegating powers and functions to another level or other statutory bodies. This Act will be useful in finalizing the preparation and implementation of Tana Delta integrated land use plan. The Tana River Delta falls within Tana River and Lamu Counties.

**The Transition to Devolved Government Act, 2012** creates a Transition Authority that will within three years ensure smooth transfer functions, powers and resources to the counties. The resources include manpower. The county governments will be responsible for county planning and management of natural resources for sustainable socio-economic development. The Authority will therefore be instrumental in proper functioning of counties.

#### **National Land Policy**

The overall vision of the National Land Policy is to guide the country towards efficient, sustainable and equitable use of land for prosperity and posterity. It deals with issues of access to land, land tenure, land administration, land use management and land information management. Land is perceived to be the most important and cherished natural asset by the Tana Delta communities and other coastal communities. The government under the National Land Policy has prioritized to address coastal land problems and injustices. In this case, under item 193 (h), *in order to address the Coastal land problems the Government shall "Protect and conserve the Tana and Sabaki Delta ecosystems in collaboration with contiguous communities"*.

The Sessional Paper No. 3 of 2009 on National Land Policy covers environmental management principles and highlights a number of environmental problems confronting Kenya including the degradation of natural resources such as forests, wildlife, water, marine and coastal resources as well as soil erosion and the pollution of air, water and land. To conserve and manage the environment, section 29 states that measures on conservation and sustainable management, ecosystem protection, urban environment management, environmental assessment and audits, shall be undertaken. Section 31 recognizes the vital need of formulating participatory environmental action plans by communities and individuals living near environmentally sensitive areas in order to take into account cultural and socio economic issues, involve local communities and individuals living contiguous to the parks and protected areas in the co-management of such areas, ensure that forests are protected for their ecosystem values and not merely to physically exclude human activities and create an effective institutional framework and capacity to implement international conventions especially those touching on access to land based natural resources.

Section 133 of the National Land Policy recognizes Kenya's diverse ecosystems which include forests, wetlands marine and coastal ecosystems, national parks, arid and semi-arid lands (ASALs), watersheds, lakes and drainage basins. Section 33 of the Policy notes that the trans-boundary nature of these resources presents a formidable management challenge because of factors such as: conflicting uses and varied governance frameworks. These factors lead to unsustainable exploitation of resources. In addition the problem of unsustainable exploitation of resources is exacerbated by inadequate enforcement of natural resource management guidelines. To ensure the protection of ecosystems and their sustainable management, Section 33 states the Government shall develop procedures for co-management and rehabilitation of forest resources, recognizing traditional management systems and sharing of benefits with contiguous communities and individuals and establish participatory mechanisms for sustainable management of fragile ecosystems in partnership with public, private and community stakeholders; and section 138 states that the Government shall ensure that all land uses and practices conform to land use plans and the principles of biodiversity protection, conservation and sustainable development.

Item 51 (d) stipulates that the Government shall establish development control standards, processes and procedures that are efficient, transparent and accountable. In addition, Item 102 provides that the Government shall put in place appropriate strategies for managing sustainable growth and development of urban

and rural areas. This policy is therefore relevant for the development of the Tana Delta Land Use Plan aimed at ensuring economic productivity of the land resources in the Delta. Currently, Land in Tana Delta is fragmented. This has occasioned several disputes due to tenure and ownership leading to serious inter-ethnic conflicts. Communities do not legally own their ancestral land and there are clear historical injustices pertaining to land rights. This has led to inequalities in land distribution as the concept of single ownership conflicts with collective community interest in land. There is serious human-wildlife conflict over land areas.

#### **The Forests Act, 2005 and Wildlife Act Cap 376 of 1976**

The Forests Act, 2005 and the Wildlife Conservation and Management Act, 2013 objectives include: the establishment, development and sustainable management, conservation and rational utilization of natural resources for the socio-economic development of the country for poverty reduction, employment creation and improvement of livelihoods within a framework where private sector, local communities and civil society institutions and other stakeholders have a role to conserve water catchment areas, create employment, reduce poverty and ensure the sustainability of wildlife and the forest sector.

The Forests Act, 2005, emphasizes participatory forest management mechanisms with Section 46(1) allowing the establishment of Community Forest Associations (CFAs). Sub-section (2) allows established associations to apply to the Kenya Forest Service Director for permission to participate in the conservation and management of a state forest or local authority forest.

This Act is currently being reviewed to align it to the Kenya Constitution 2010, taking cognizance of the devolved governance structures. It provides for sustainable management of forests and forest products in the country. It establishes and empowers community forest associations (CFAs) to manage forests and support participatory forest management. Currently, only one CFA exists in the entire Tana Delta, and has not been empowered adequately to manage the forests ecosystems herein. Tana Delta has many forest ecosystems which support biodiversity and livelihoods of the communities. They include mangroves, floodplains, dryland forests and riverine forests. There is currently a failure to tap the benefits of indigenous knowledge about the forest resources and their management within Tana Delta.

There is a need to increase the coverage of CFAs throughout the entire Delta and to pick up the special characteristics of riverine forests (Tarasaa CFA covers an area of dryland forest). In Tana Delta, there are

different forests including riverine forests, dryland forests, floodplain and mangroves, which are important habitats for wildlife and a source of livelihood to many communities in the Delta. There is however widespread allegations of neglect by the government agency mandated with forest protection, KFS, including lack of protection and recognition of indigenous forests. This has therefore rendered many forests ecosystems degraded and over-exploited through human induced pressures. KFS has paid special attention to the mangrove forests, considered government forests. The riverine and the floodplain forests patches are critical habitats for the rare and endangered Tana River primates. The management of Tana Delta forests depends on the good will of communities and conservation agencies who often find themselves at loggerheads with forest users.

### **The Environmental Management and Coordination Act, 1999**

The Environmental Management and Co-ordination Act (EMCA) of 1999, in its Part 1, takes into account integration of several sectors that deal with natural resources detailing multi-sectoral approaches to management of environment and natural resources coordinating all sectors that have a role in environmental management. EMCA recognizes the principle of sustainable environmental management embracing cultural and social principles traditionally applied by communities in Kenya for the management of natural resources and addresses issues relating to protection of forests (Section 48), reforestation and afforestation (EMCA, Section 46), energy conservation and planting of trees or woodlots (EMCA, Section 49) and conservation of biological diversity (EMCA, Section 50) in tandem with the Kenya Constitution, 2010, and the National Land Policy, Sessional Paper No. 3 of 2009.

Section 3(3) of EMCA opens the way for substantial public involvement in any major development decisions, which have an environmental bearing where the public shall have recourse to law. In the same section, the public shall be listened to in matters to do with land use change, which includes conversion of forestland to other uses and Part IV, Section 58-67 of EMCA 2 1999, requires Environmental Impact Assessment (EIA) done by an independent body before any developments on land are undertaken. The EMCA (Section 125) has also made provisions for addressing the environmental offences including the establishment of a tribunal to deal with such offences.

The EMCA Part V (Section 42-57) deals with protection and management of rivers, lakes and wetlands; hill tops, hill sides, mountain areas and forests; conservation of energy, biological diversity and biological resources among other natural resources.

Section 4 of EMCA, 1999 recognizes NEMA as a coordinator through the National Environment Council that includes Ministries of Agriculture, Economic Planning and Development, Energy, Environment, Finance; public universities; specialized research institutions engaged in environmental matters; and NGOs. Within EMCA institutional coordination structures are provided for, including section 4(1) that establishes the National Environment Council (NEC), section 7(1) that establishes the National Environment Management Authority (NEMA), National Environment Trust Fund (Section 24(1), National Environment Restoration Fund (Section 25(1) and a number of national statutory and decentralized environment committees at the provincial and district levels that are directly linked to NEMA at the national level as detailed in Section 29(1) of EMCA 1999.

These coordination structures at national, provincial and district level are composed of multi-sectoral institutions including representatives of civil society and local communities. Section 9 (2) (a) describes the coordination role of NEMA on environmental management activities undertaken by lead agencies. However, despite this enabling coordination policy support for NEMA, there is hardly any national coordination of inter-ministerial or inter-sectoral agencies outside management boards.

EMCA has established a number of regulations in order to sustainably manage the country's resources. Specific regulations of relevance to the development of the Tana Delta LUP/SEA include; Environmental Management and Co-ordination (Impact Assessment and Audit Regulations, 2003), the Environmental Management and Co-ordination (wetlands, river banks, lake shores and sea shore management) Regulations, 2009, Environmental Management and Co-ordination (Water quality Regulations, 2006) Environmental Management and Co-ordination (Waste Management Regulations, 2006) Environmental Management and Co-ordination (Biodiversity and Access and Benefit Sharing Regulations, 2006).

### **Kenya Vision 2030**

The Kenya Vision 2030 is the development blue print for the country which was launched in 2008 to help the country to transform to a middle income and newly industrialized country by the year 2030. The vision is anchored on 3 pillars namely political, economic and social pillars. Under the social pillar, the vision appreciates that Kenya's journey towards prosperity involves the building of a just and cohesive society, enjoying equitable social development in a clean and secure environment. The Vision has provided for flagship projects within the River Tana catchment and the Tana Delta such as Irrigation farming, High Grand Falls Dam and Lamu Port. However, these projects may conflict

with sustainable development goals if appropriate mitigation measures are not provided for in the planning and design particularly on the water infrastructure. Water is a key driver of all the social, economic and ecological flows (needs) in the Delta, thus planning for water is a pre-requisite towards achievement of Vision 2030 goals in the context of the Delta.

### **Other Relevant Policies and Legislative Frameworks**

**The County Government Act, 2012** tasks the county governments to prepare county plans. Article 102(1) of the Act empowers the County Government to plan for the county and further states that no public funds shall be appropriated outside a planning framework developed by the County Executive Committee and approved by the County Assembly. The county planning framework shall integrate economic, physical, social, environmental and spatial planning.

**The Physical Planning Act** mandates the Director of Planning to prepare various types of physical development plans (regional and local) which provide the physical development framework for affected areas. Section 29 of the Act empowers Local Authorities to prohibit or control the use and development of land and buildings in the interest of proper and orderly development of an area. Section 36 stipulates the requirement for conducting of an Environmental Impact Assessment for any development that is likely to have injurious effects to the environment or is particularly large in scale.

**The Agriculture Act, Cap 318, Section 48** promotes soil and water conservation and prevents the destruction of vegetation giving the Agriculture Minister powers to make rules for land preservation by prohibiting, regulating or controlling clearing of land for cultivation; grazing or watering of livestock; firing, clearing or destruction of vegetation.

**The Energy Policy Sessional Paper No. 4 of 2004** recognizes at both the vision and the mission of the policy the provision of energy services while protecting the environment including correcting the supply-demand imbalance on biomass energy resulting in their unsustainable harvesting and degradation of ecosystems and catchment areas.

**Section 103 (2) of the Energy Act, 2006**, empowers the Minister to promote the development and use of renewable energy to include promotion of the use of fast maturing trees for energy production including biofuels and the establishment of commercial woodlots including peri-urban plantations.

**The National Museums and Heritage Act, 2006** sets aside a protected area where the Minister in charge can prohibit, restrict access to, or development of, or use for agriculture or livestock, or any other activity that is liable to damage as monument or archaeological object. However, this Act defines a protected area as a site on which a buried monument or object of archaeological interest exists, and the adjoining land which has been declared by the Minister to be protected area. This definition does not adequately cover management of forest resources explaining why most of the Kayas (sacred forest patches at the Kenya coast) established under this law have been under threat from cultivation, charcoal burning and mining.

**The National Environment Policy, 2013**, gives prominence to fragile ecosystems such as the Tana Delta and promotes the wise-use and sustainable utilization of the resources. The policy has set in motion practices towards sound environmental management through public participation and benefit sharing approaches. Environmental management is currently vested on different institutions posing the challenge of coordination and or/overlapping roles and mandates hence conflicts.

National Environment Policy, 2013, provides for sound environmental and natural resource management in line with sustainable development. It highlights the interlinkages between sustainable natural resources management and human development and that improving human well being is vested on sound conservation and wise use of the country's natural capital. Tana Delta has vast and enormous natural resources including wetlands, marine and forests that must be managed in a sustainable manner for improved livelihoods of the dependent communities. The National Environment policy (2013) anticipates adoption of Ecosystem Based Management and holistic approaches recognizing the intimate and intrinsic connectivity between upstream and downstream wetland users.

### **Institutional Aspects**

The review of institutions responsible for direct natural resources conservation and management showed that the Ministry of Environment, Water and Natural Resources; Ministry of Sports, Culture and The Arts; Ministry of Lands, Housing and Urban Development and Ministry of Mining are responsible for the management and conservation of natural resources in Kenya. The Ministry of Environment, Water and Natural Resources houses five government agencies: Kenya Forest Service, Kenya Wildlife Service, the Kenya Forestry Research Institute (KEFRI), the National Environment Management Authority (NEMA) and the Department for Resource Surveys and Remote Sensing (DRSRS) while



the Ministry of Sports, Culture and The Arts houses the National Museums of Kenya.

A review of twenty natural resources conservation and management functions showed that the Kenya Wildlife Service (KWS) is responsible for sixteen (16) mandates while the Kenya Forest Service (KFS) is responsible for thirteen (13) and NEMA is responsible for nine. The National Museums of Kenya (NMK), KEFRI and DRSRS are responsible for seven, six and four respectively. The KWS and KFS are jointly responsible for: management and protection of forests; formulation of policies for forest management; preparation and implementation of management plans; management of National Reserves; management of local and private sanctuaries; biodiversity research and monitoring; setting out of environmental offences; provision of measures for environmental restoration; establishment of regional conservation committees; collection, storage, archiving, analysis, update and dissemination of geo-spatial data on natural resources; promotion of rational wildlife and forestry resources utilization; promotion of education and environmental awareness and setting up procedures for natural resources planning.

### **Inter-government Agency Collaboration**

The Forests Act 2005 establishes the KFS and the Wildlife Conservation and Management Act of 2013, establishes KWS. Section 7 (j) of the Forests Act 2005, mandates the Forest Board to develop modalities and guidelines for joint management of forests between the Service, local authorities, forest communities, government agencies and the private sector and section 36 empowers the KFS director to enter into an agreement with any persons to manage the forests jointly. Like the Forests Act and the Wildlife Act, the water policy, the Water Act, 2002, the Agriculture, Fisheries and Food Authority Act, 2013, the National Museums and Heritage Act, 2006, and the County Governments (amendment) Act, 2013 oblige the Water Resources Management Authority under Ministry of Water, the National Museums of Kenya and the local authorities to collaborate in natural resources management including finance, local authorities, forests and wildlife, fisheries, regional development authorities, and NGOs in their management boards.

The National Land Policy, 2009 provides for setting up of three key land management institutions: the National Land Commission (NLC), the District Land Boards and Community Land Boards whose composition include democratically elected community representatives and will have the mandate of promoting equitable access to land, conservation of cultural sites, protecting minority land rights and redressing historical injustices. The community Land Boards are mandated to manage, document and regulate all transactions of community

lands—which should include forests. These boards have not yet been established making the good National Land Policy serve as just a paper pack and an academic exercise. Section 6 of the Energy Act, 2006, provides for powers of the commission that include formulating, enforcing and reviewing environmental, health, safety and quality standards for the energy sector, in coordination with other statutory authorities. The Act's recognition of other sectors is superficial recognizing EMCA 1999 but with minimum reference to forests and their resources.

## **International and Regional Policy Context:**

### **Multi-lateral Treaties and Agreements**

Article 2 sub-article 6 of the Kenya Constitution 2010 states that 'any treaty or convention ratified by Kenya shall form part of the law of Kenya under the constitution' implying that it is now possible for any aggrieved party to sue any violation or infringement of environmental right based on an international treaty or convention that Kenya is party to. Kenya is a signatory to a number of international treaties and conventions touching on environment, socio-economic development, poverty alleviation, food security, among others.

### **Millennium Development Goals**

The Millennium Development Goals (MDGs) are eight international development goals that all 193 United Nations member countries and at least 23 international organizations ratified and agreed to achieve by 2015. Two goals are critical to land use planning: Goal 1-eradication of extreme hunger and poverty and Goal 7-ensure environmental sustainability.

Targets in the goal of eradicating extreme poverty and hunger are to: halve the proportion of population living on less than one dollar a day and those who suffer from hunger, and achievement of decent employment for women, men, and young people.

The goal of ensuring environmentally sustainable targets are to: integrate the principles of sustainable development in the country's policies and programs in order to reverse loss of environmental resources and reduce biodiversity loss and halve the proportion of people without access to safe drinking water and basic sanitation.

### **Ramsar Convention 1971**

The Ramsar Convention (1971) is the intergovernmental treaty that specifically addresses sustainable management of wetlands. Tana Delta is Kenya's sixth Ramsar site, having been designated in October 2012. The Ramsar convention calls for sustainable utilization and management of the deltaic wetland resources through the wise-use principle which can be realized through



preparation of an integrated land use frameworks. This principle allows for careful use and sustainable management of wetland resources for improved community livelihoods and biodiversity conservation.

The convention lays a lot of emphasis on wetlands wise-use and promotes sustainable practices and management of wetlands. Kenya ratified this Convention in 1990 and since then enlisted six (6) wetlands as Ramsar sites-wetlands of international importance, mainly the rift valley lakes. They include Lake Nakuru, L. Naivasha, L. Baringo, L. Bogoria, L. Elementaita and the newest in the list is Tana Delta Wetland.

The Convention provides a broad definition of wetlands as “Areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salty, including areas of marine water, the depth of which does not exceed six metres. In addition wetlands may incorporate riparian and coastal zones adjacent to wetlands, and islands or bodies of marine water deeper than six metres.” This poses a serious challenge to contracting parties that do not have for example certain wetlands described thereunto. Thus the convention has provided room for localized and contextualized definition for contracting parties. This is because decision-making on wetlands management is strictly a national activity that is affected by the national goal-setting but also by international conventions.

#### **Convention on Biological Diversity (CBD)**

Of strong relevance to the Ramsar Convention is the Convention on Biological Diversity (CBD), which acts very much as an overarching structure, to which other conventions with their own more precise focus, can and must relate and contribute. The world community's growing commitment to sustainable development has inspired this convention. It represents a dramatic step forward in the conservation of biological diversity much of which is derived and supported by wetland ecosystems including Tana Delta, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources.

The Convention on Biological Diversity requires Parties to use EIA effectively to avoid or minimize significant adverse impacts on biodiversity; it introduces Strategic Environmental Assessment (SEA) to assess environmental implications of policies and program particularly for those with major implications for natural resource use, for example, agriculture/ irrigation and other land use changes. Wetlands biodiversity is heavily recognized by this Convention.

The Convention also led to formation of the Cartagena Protocol on Biosafety of 1999 namely “*The Cartagena Protocol on Biosafety to the Convention on Biological Diversity*”. This is an international treaty governing the movements of Living Modified Organisms resulting from modern biotechnology from one country to another. It was adopted on 29<sup>th</sup> January 2000 as a supplementary agreement to the Convention on Biological Diversity and entered into force on 29<sup>th</sup> January 2000. Kenya signed the protocol on 15<sup>th</sup> May 2000; ratified it on 24<sup>th</sup> January 2002 and become a party member on 11<sup>th</sup> September 2003.

Tana Delta is a Key Biodiversity Area (KBA), an Important Bird Area (IBA) and home to many biodiversity elements including the IUCN red-listed ones such as the critically endangered Tana Crested Mangabey, *Cercocebus galeritus galeritus*, which is endemic to the Lower Tana River forests and the endangered Basra Reed-Wabler (*Acrocephalus griseldis*) among others.

#### **The Convention on International Trade in Endangered Species (CITES)**

Kenya signed the Convention on International Trade in Endangered Species (CITES) in 1999 and regulates trade in endangered species of wild fauna and flora. Kenya is enormously rich in biodiversity. However loss of biodiversity through destruction of habitats and poaching and climate change pose a real threat not only to revenue and employment but also livelihoods and source of food for some communities. Tana Delta is not immune to loss of biodiversity. Poaching and destruction of habitats are prevalent in the delta.

#### **The United Nations Framework Convention on Climate Change (UNFCCC)**

The United Nations Framework Convention on Climate Change (UNFCCC), 1992 requires parties to take climate change considerations into account, to the extent feasible. It emphasizes on the need of incorporating the consideration in relevant social, economic and environmental policies, plans and actions, and encourage the employment of appropriate methods, for example impact assessments to be formulated and determined nationally, with a view of minimizing adverse effects on the economy, public health and the quality of the environment. Deltaic wetlands play significant roles in micro-climate enhancement and act as strong water storage systems during dry-season. It is therefore imperative to address and institute measures to mitigate and/or adapt to the climatic scenarios in the Tana Delta. This framework is therefore triggered as the impacts of climate change are evidenced within the delta and Kenya as a whole. The Government has developed National

Climate Change Response Strategy (NCCRS, 2010) as well as an Action Plan aimed at reducing the impacts of climate change and maximising opportunities brought by climate change. Deltaic environments and wetlands in general constitute some of the most vulnerable ecosystems to climate change and variability manifested through extreme droughts and flooding, sedimentation and loss of biodiversity.

#### **Nairobi Convention and the Africa-Eurasian Water Bird agreement (AEWA)**

At the regional scale, the African-Eurasian Water Bird Agreement (AEWA) developed in 1993 from deliberations of the Bonn Convention which held its first consultative meeting of range states of African-Eurasian Water bird Agreement (AEWA) in Nairobi in June 1994, is another agreement that offers a good opportunity for the management and conservation of Tana Delta and associated wetlands biodiversity resources. This agreement is triggered by the fact that there are several migratory water birds from Europe that use the Tana Delta as a wintering site. The Delta holds significant

proportions of globally threatened migrant water birds including Madagascar Pratincole *Glareola ocularis*. The vast numbers of migratory and resident waterbirds are particularly dependent on the seasonally flooded grasslands and Borassus Palm savannah that cover some 70,000 ha in the heart of the Tana River Delta.

The Kenyan Government became a signatory to the Nairobi Convention on 30th May 1996. The Government has adopted measures to implement the Convention and its Emergency, Protected Areas and Land Based Sources of pollution Protocols. Currently, Kenya is actively involved in the development process for the Integrated Coastal Zone Management (ICZM) Protocol to the Nairobi Convention. In this case, with support from the Government, Nairobi Convention Secretariat and partners, an integrated coastal zone management (ICZM) framework together with an action Plan has been developed for the Kenya coastal zone to which Tana is part of. The ICZM provides for the sustainable management of marine and coastal resources within the Western Indian Ocean (WIO) region.

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