Kilombero Valley, United Republic of Tanzania

Ramsar Site No. 1173

Ramsar Advisory Mission Report

April 2017

Ed Wilson, Robert McInnes, Damas Patrick Mbaga and Paul Ouedraogo

[Page left blank for double-sided printing]

Contents

List of Abbreviations

AGG	Agricultural Green Growth
ASL	Above sea level
BWOs	Basin Water Offices
CBNRM	Community Based Natural Resource Management
cumecs	Cubic metres per second
DLUFP	District Land Use Framework Plans
DC	District Commissioner
DFT	District Facilitation Teams
EFA	Environmental Flow Assessment
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EU	European Union
GCA	Game Controlled Area
GoT	Government of Tanzania
GR	Game Reserve
IWRM	Integrated Water Resources Management
IWRMD	Integrated Water Resources Management and Development
KGCA	Kilombero Game Controlled Area
KILORWEMP	Kilombero and Lower Rufiji Wetlands Ecosystem Management Project
KVOC	Kilombero Valley Ornithological Centre
KVTC	Kilombero Valley Teak Company
KVRS	Kilombero Valley Ramsar Site
LGAs	Local Government Authorities
mamsl	Meters above mean sea level
MNRT	Ministry of Natural Resources and Tourism
MoWI	Ministry of Water and Irrigation
NEMC	National Environmental Management Council
PA	Protected Area
PMO-RALG	Prime Minister's Office Regional Administration & Local Government
RAM	Ramsar Advisory Mission
RAMCEA	Ramsar Centre East Africa
RBWB	Rufiji Basin Water Board
RIS	Information Sheet on Ramsar Wetlands
RS	Ramsar Site
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
SRESA	Strategic Regional Environmental and Social Assessment
ToR	Terms of Reference
USAID	United States Agency for International Development
VPO	Vice President's Office
WMA	Wildlife Management Area
WUAs	Water User Associations

Recommendations from the Mission

Preamble

i. The Ramsar Advisory Mission (RAM) has reviewed a variety of reports, peer-reviewed publications and presentations and undertaken consultations with a range of stakeholders including local communities within the KVRS, government representatives and donor agencies. The information reviewed, the views listened to and the observations made on the ground and from the air have allowed the RAM team to develop a robust understanding of the issues relating the wise use of wetlands and the status of the Kilombero Valley Ramsar Site (KVRS).

ii. The KVRS remains internationally important and provides essential benefits to both the local communities living around the area and to the wider wellbeing and prosperity of the United Republic of Tanzania.

iii. However, the KVRS is under intense pressure and subject to unsustainable levels of negative human-induced change which is compromising the ecological character of the site.

iv. Land use change has been progressive and is accelerating as areas of wetland and native grassland are being replaced by arable land. The change in the land use and the intensification of human activities such as cattle grazing, ploughing, irrigation and burning is severely compromising the multiple values that the site provides to human society.

v. Key ecological components, such as large mammal populations, are effectively gone from the site and changes in other components, such as soil carbon, are of serious concern.

vi. Urgent action is therefore required to stem this loss and degradation and to place the wetlands on a more sustainable trajectory. The priority should no longer be to establish proactive wetland management but should shift to also include the delivery of a programme of wetland rehabilitation and restoration. Proactive management alone will not reinstate the degraded wetlands of the Kilombero Valley.

Recommendations

vii. A series of fourteen recommendations have been developed. Whilst presented as separate recommendations, many of the issues they address and the outcomes that they seek relate to cross-cutting issues. Therefore the recommendations should not be considered in isolation, rather they represent a coherent whole which require to be implemented in a holistic manner.

viii. The fourteen recommendations are described below:

Recommendation 1: Address cross-cutting issues
Ensure that wetlands are considered appropriately within and across all major development and natural resource management related initiatives through the establishment of appropriate champions, stakeholders or representation and where necessary adopt a precautionary approach.

Recommendation 2: Update the RIS for the KVRS
Describe fully the current ecological character of the site and re-examine the criteria for which the KVRS qualifies for inclusion on the list of wetlands of international importance.

Recommendation 3: Develop a management plan for the KVRS
Use a participatory approach to develop a robust management plan for the Ramsar Site that provides the overarching framework for natural resource management within the Kilombero Valley.

Recommendation 4: Create a 'Wetlands Division' in MNRT
Create a new division within MNRT to take the lead responsibility for wetland conservation and wise-use in Tanzania.

Recommendation 5: Establish a management authority for KVRS
Establish, constitute and enable the operation of a dedicated management authority or committee drawn from multiple sectors and stakeholders to facilitate the integrated management of the Ramsar Site.

Recommendation 6: Develop a hydrological model for the Kilombero sub-basin
Develop a hydrological model, which goes beyond the current approaches applied in the IWRMD plan and the EFAs, that can fully simulate the eco-hydrological functioning of the KVRS and the wider Kilombero Valley so that genuinely informed decision-making can be undertaken with regards to water resource management and socio-economic development options.

Recommendation 7: Ensure the sustainability of all irrigation schemes
Ensure that all irrigation schemes are subject to appropriate environmental impact assessments, are modelled appropriately to understand the water resource management and environmental flow implications and are designed, constructed and operated in line with best environmental standards.

Recommendation 8: Improve hydrological data resources
Enhance and develop the existing hydrological monitoring network to ensure that robust and reliable data are available for decision-making.

Recommendation 9: Adopt a sustainable approach to livestock management
Develop and implement fully a robust, integrated and coherent national livestock plan and strategy which will deliver a long-term solution to livestock management not only within the KVRS but across Tanzania.

Recommendation 10: Raise awareness of the importance of wetlands
Work with a range of stakeholders and through a variety of media to develop, implement and monitor a robust awareness raising programme that explains, describes and promotes the importance of wetlands for human wellbeing.

Recommendation 11: Build and strengthen capacity in key institutions and organizations
Improve knowledge, understanding and resourcing within key organizations and institutions across the KVRS and the wider basin in order to facilitate improved water and natural resource management.

Recommendation 12: Promote sustainable land management in the Kilombero River catchment
Develop an integrated land management approach across the Kilombero River catchment which seeks to reduce downstream impacts on the ecological character of the KVRS.

Recommendation 13: Develop a prioritised restoration plan for KVRS
Develop a prioritised restoration and rehabilitation plan for the degraded areas of the KVRS in order to restore the ecological character of the site.

Recommendation 14: Establish a RAM implementation action plan
Develop an implementation plan that will allow progress on the recommendations to be assessed and reported on through the triennial Ramsar National Reporting cycle.

1. Background

1.1. Overview of the wetlands of Tanzania

Tanzania possesses a variety of wetlands in the form of lakes, rivers, springs, reservoirs (man-made and artificial) and aquifers with potential internal renewable water resources (Kamukala, 1993). Wetlands in Tanzania cover about 88,500 km2 or 10% of the land area of the country (URT, 2012). They provide essential ecosystem services which support economic development and the resilience of the Tanzanian environment and society (Mwakaje, 2009; Mombo et al., 2011). Large wetlands are facing growing pressure from human use: agricultural expansion and intensification, catchment changes, hydropower development, loss of habitats, over exploitation of grazing and aquatic habitats and loss of floodplain wildlife populations. In the National Report submitted by the Government of Tanzania to the Twelfth Conference of the Parties to the Ramsar Convention in 2012, the overall status of wetlands, including Ramsar Sites, was recorded as deteriorating, primarily as a result of unsustainable uses, especially encroachment from agriculture and grazing (URT, 2014).

Several wetlands are under increasing pressure and in the process of losing many of their important functions, with serious consequences in the form of changed water regimes, significant conflicts over resource use, and loss of livelihood opportunities (Jenkins et al, 2002; Hamisi et al., 2012). Many wetland areas have experienced a rapidly growing human population with poor people moving into the areas in search of livelihood opportunities**,** leading to a strong, short-term economic pressure for conversion of wetlands to other land uses with only limited considerations being given to the sustainability of the changes (Kashaigili et al., 2006).

Tanzania acceded to the Ramsar Convention in August 2000 committing to conserve and promote wise use of its wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development. Four Tanzania sites have been listed within the Ramsar list: 32 500 km^2 Malagarasi-Muyovozi Ramsar Site (RS) (2000); 2,250 km^2 Lake Natron RS (2001); 7,950 km^2 Kilombero Valley RS (2001); 5,970 km^2 Rufiji-Mafia-Kilwa Marine RS (2002).

As with the situation elsewhere in East Africa (van Dam et al., 2011; Namaalwa et al., 2013), wetland management in Tanzania is very sectoral. The designated Ramsar Administrative Authority in the country is the Vice President's Office (VPO). However, many other government institutions, at both national and sub-national levels, have an active role to play in the management of wetlands. This presents challenges in

converting democratic governance structures into democratic performance in pursuit of environmental or developmental objectives (Smucker et al., 2015). This means that there is increased potential for the multiple functions of wetlands to be overlooked by one sector or level of governance and moreover existing lessons learned on sustainable wetland management may not be available for use by key stakeholders in other sectors or in civil society. This non-systemic approach to wetland management is not unique to Tanzania but it symptomatic of institutional failures common to many situations and countries (Everard and McInnes, 2013).

1.2. Kilombero Valley Ramsar Site: Ecological character description

Introduction

The Ramsar Sites network constitutes the largest network of officially recognized internationally important areas in the world. This network of wetlands constitutes the backbone of a global network of wetlands that maintain vital functions and provide ecosystem services for people. The identification and the management of these wetlands, for conservation and sustainability, is a core purpose of the Convention, essential for the realization of long-term benefits for biological diversity and people taking into account different approaches and visions.

The importance of the global network of Ramsar Sites is clearly articulated in the Convention's 4th Strategic Plan 2016-2024 under Goal 2 which states that "*Parties must commit themselves to efforts to protect and effectively manage the existing Ramsar Sites and enable the full and effective participation of stakeholders, including indigenous peoples and local communities, as well as to expanding the reach of the Convention by continuously working to add more sites and areas of wetlands recognized under the Convention*."

Throughout its evolution, the Ramsar Convention has developed criteria for the designation of Wetlands of International Importance (Ramsar Sites). These criteria have been kept under constant review. The Convention has supplemented these with regularly updated Guidelines to assist Contracting Parties with their interpretation and application of the Criteria reflecting the development of conservation science.

Ramsar Sites should be selected for inclusion on the List of Wetlands of International Importance on account of their international significance in terms of ecology, botany, zoology, limnology or hydrology. To assist with this process, the Convention has adopted nine criteria for identifying a Ramsar Site (Annex 8.1). While a Site may only need to satisfy one criterion to qualify for inclusion on the List, in practice Ramsar Sites are often designated on the basis of multiple criteria.

[redacted]Furthermore, the Ramsar Convention (2005) has defined wise use of wetlands as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development", and wetland ecological character as "the combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time".

[redacted]Therefore the description of the ecological character embraces not just the features for which the site qualifies for inclusion on the List but also the wider ecosystem components, processes and ecosystem services. Hence understanding and defining the ecological character of a Ramsar Site is a prerequisite in order to ensure delivery of wise use.

Qualifying features

[redacted]At the time of designation (2 May 2002), the Kilombero Valley Floodplain Ramsar Site (KVRS) qualified for inclusion on the List, as described in the Information Sheet on Ramsar Wetlands (RIS), on the basis of the following eight criteria (full descriptions provided in Annex 8.2):

- **Criterion 1:** The wetland was considered internationally important as it contained a representative, rare, and unique example of the largest seasonally freshwater lowland floodplain in East Africa.
- **Criterion 2:** The wetland contained almost 75% of the world's population of the wetland dependent Puku Antelope *Kobus vardonii* listed as near threatened on the IUCN Red List of Threatened Species.
- **Criterion 3:** The wetland was considered internationally important because it supported populations of *inter alia* Puku Antelope, Udzungwa Red Colobus *Piliocolobus gordonorum* and three endemic bird species (Kilombero Weaver *Ploceus burnieri* and two undescribed species of cisticolas considered important for maintaining the biological diversity of a particular biogeographic region.
- **Criterion 4:** The wetland provided a refuge during the dry season for species, including Puku Antelope, African Elephant *Loxodonta africana*, hippopotamus *Hippopotamus amphibius* and African Buffalo *Syncerus caffer*, which were using the Selous-Kilombero ecosystems and two species of fish, *Citharinus congicus* and *Alestes stuhlmanni* which were dependent on the Kilombero floodplain for spawning.
- **Criterion 5:** Despite a lack of hard evidence, the wetland was considered to support more than 20,000 or more waterbirds.
- **Criterion 6:** The wetland was considered internationally important as it regularly supported more than 1% of the individuals of the global population of African Open-billed Stork

Anastomus lamelligerus , Whiteheaded Plover *Vanellus albiceps* and African Skimmer *Rhynchops flavirostris*.

- **Criterion 7:** The wetland was considered internationally important as it supported 23 species, including two indigenous fish subspecies, and that the fish populations were representative of wetland benefits and values.
- **Criterion 8:** The wetland was considered internationally important as it represented a crucial breeding and nursery ground for fish for the whole of the Rufiji Basin.

[redacted]At the time of designation, Criterion 1 was considered to be the most significant criterion applicable to the Site. This criterion emphasised the critical importance that the KVRS played not just in terms of global ecology and biodiversity, but also with regard to the regulation of flow and the provision of nutrients and sediments downstream within the Rufiji Basin. This linkage even extended to the explicit contribution that the Kilombero Valley makes to the Rufiji-Mafia-Kilwa Marine Ramsar Site.

[redacted]Under Criteria 3 and 4 the KVRS is also recognised as providing important corridors for large mammal species migration across the valley joining the wildlife areas adjacent to the KVRS (Udzungwa National Park/Nature Reserve, Selous Game Reserve as well as numerous Wildlife Management Areas and Forest Reserves). However, in recent years the quality and integrity of these corridors has been much depleted (Jones et al., 2012).

Wetland types

[redacted]The Ramsar Convention has defined wetlands as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”. The Convention has also adopted a classification of wetland types based on a range of criteria, including inter alia whether it is marine or inland, whether is permanently or seasonally inundated or whether it is forested or not.

[redacted]Within the RIS, at the time of designation, the following nine types of wetland were listed, reflected the eco-hydrological complexity of the area and the scale of the site which extends over 796,735 ha:

- Seasonal/intermittent freshwater marshes/pools
- Permanent rivers/streams/creeks
- Seasonal/intermittent/irregular rivers/streams/creeks
- Freshwater, tree-dominated wetlands
- Permanent freshwater marshes/pools
- Permanent inland deltas

- Shrub-dominated wetlands
- Seasonal/intermittent freshwater lakes (over 8 ha)
- Permanent freshwater lakes (over 8 ha)

Description of ecological character

[redacted]The information captured under the description of the eight criteria upon which qualification for listing was achieved and the types of wetland present go some way to describing the ecological character of the Site. However, a variety of other ecosystem components, processes and benefits/services were also captured in the RIS and which are considered as fundamental elements of the ecological character of the Ramsar Site. These elements include *inter alia*:

- Maintenance of soil fertility through annual flooding.
- Storage of carbon in mbuga waterlogged soils.
- Regulation of downstream water supplies and flood risk through storage of rainfall-generated flooding within the floodplain suppressing the peak hydrograph.
- Provision of grassland for informal grazing of livestock.
- Provision of food through grazing livestock, cultivation of crops, including rice, maize and vegetables, and capture and artisanal fisheries.
- Provision of hunting as a licenced tourist activity.
- Provision of illegal hunting.
- Provision of timber through legal, commercial forestry.
- Collection of firewood by local people.
- Collection and harvesting of traditional, medicinal plants.
- Development of scientific research and educational activities.
- Provision of limited birdwatching.

[redacted]Consideration of the maintenance of ecological character and reporting on whether it has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference should be based on information articulated in the RIS and in any subsequent update. Therefore, the evaluation of the KVRS within the scope of the RAM is undertaken against the description of ecological character provided in the 2002 RIS and, given the requirement to update the RIS at least every six years, more recent information that would be available for a subsequent update.

1.3. Background to the Ramsar Advisory Mission

[redacted]In February 2015, Giuseppe Daconto (International Technical Assistant & Co-Manager of the Kilombero and Lower Rufiji Wetlands Ecosystem Management Project-KILORWEMP), Mr Pellage Kauzeni (Manager of KILORWEMP Project) and Paul Ouedraogo (Senior Advisor for Africa at the Ramsar Convention Secretariat) began discussions on undertaking a

Ramsar Advisory Mission (RAM) to Tanzania to assist the Government on the further development of the policy framework and on the required strategies to strengthen the local context of wetland management in the KVRS. The recommendations would be based on successful strategies for reducing several types of threats to floodplains that have been used in other river basins in Africa.

[redacted]In May 2016, the Ramsar Secretariat received an official request from the Vice President's Office inviting the Secretariat to conduct an advisory mission to KVRS.

Objectives of the RAM

[redacted]The objectives of the mission as set out in the Terms of Reference (ToR) were:

- To review and provide advice on the policy framework pertinent to the KVRS and specifically the ways in which, and the extent to which, the Ramsar Convention's provisions have been, or should be, reflected in Tanzanian policies, plans relating to this case, and in the decision-making processes being followed at site level.
- To review and provide advice on the implications of current key economic development initiatives in the KVRS for wetland management, namely irrigation development and the development of an Integrated Water Resource Management (IWRM) plan for Rufiji basin; and how best to reconcile those processes with KVRS management measures. Assess the actions to put in place to prevent potential impact on the Ecological Character of the Site
- To share technical experience on the best practices; structures, systems and processes of sustainable wetlands management in the world that would improve the efficiency of wetlands management in Tanzania.
- To provide advice on the possible ways to support Sustainable wetlands management programme in Tanzania both technically and financially.

RAM Team

[redacted]A RAM Team was established, composed of specialists in different aspects of wetland wise use and conservation, the management and restoration of wetlands, and hydrology. The team members were:

- Edward Wilson, Sisyphus Natural Solutions, an independent consultant for conservation and sustainable development,
- Robert McInnes, Managing Director of RM Wetlands & Environment Ltd, an expert in the wise use of wetlands and related environmental issues;

- Damas Patrick Mbaga, Hydrologist at the African Wildlife Foundation (AWF) and,
- Paul Ouedraogo, Ecologist and Senior Advisor for Africa at the Ramsar Convention Secretariat.

During the Mission, the team was accompanied by Giuseppe Daconto (International Technical Assistant & Co-Manager of KILORWEMP Project), Mr Pellage Kauzeni (Manager of KILORWEMP Project), Mr Seleman Kisimbo from Vice-President's Office and some Staff (Site level) from KILORWEMP Project. The itinerary and logistics for the mission was organized by both the Kilombero and Lower Rufiji Wetlands Ecosystem Management (Project-KILORWEMP) and the Belgian Development Agency-BTC-Tanzania.

Itinerary

The Mission was conducted over an eight day period, from 6th to 18th November 2016. The full itinerary is provided in Annex 8.3. During the course of the mission, the team held several meetings with a range of key stakeholders, including representatives from the villages, districts, fishing communities and government ministries and agencies.

1.4. Importance of the RAM recommendations

The review of background material, the broad consultations undertaken as part of the Mission, and the holding of a workshop convened to provide an opportunity to discuss strategies and policy implementation options for the sustainable management of large wetland landscapes in Tanzania, were justified by the fact that the KVRS is at the same time a prime catchment for water resource management, a productive landscape and a key biodiversity area.

Within this context, the RAM could therefore be considered as a test case for Tanzania to strengthen its framework and capacities to handle similar complexities in the future. Therefore, the recommendations of the RAM can be of wider relevance and applicability in the national context.

The recommendations arising from the RAM are critical, essential and important. They consider possible weaknesses and gaps that impede the achievement of the objectives of the wise use of wetlands in Tanzania. They are essential because they cover socio-economic development sectors. Finally, they are important because they concern the environment, one of the three pillars of sustainable development.

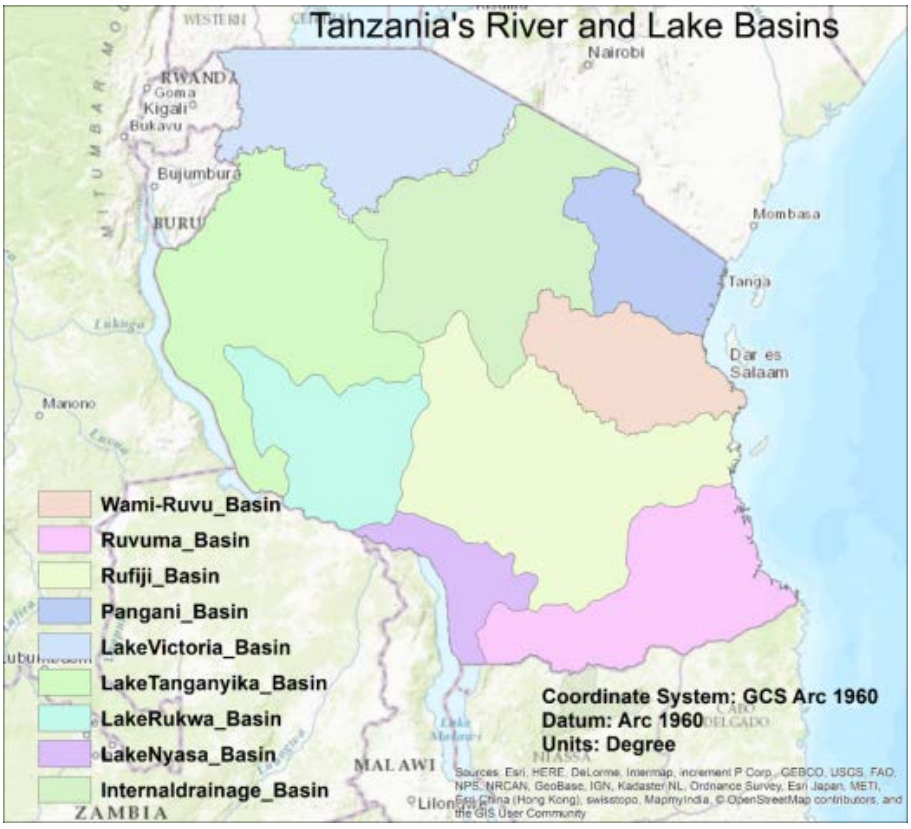
2. Hydrological and wider context of the Kilombero Valley Ramsar Site

2.1. Background

From a water resource management perspective, the Water Utilization (Control and Regulation) Act of 1974 (Act No. 42) amended by the Water Utilization (Control and Regulation) Act of 1981 (Act No. 10) gazetted Tanzania into nine river and lake basins (Figure 1). Of these, seven are trans-boundary. The river and lake basins are allocated within the following five hydrographic networks:

- The "Indian Ocean" network which covers 476,890 km² and occupied by Rufiji, Wami Ruvu, Pangani, Lake Nyasa and Ruvuma basins all together accounting for about 50% of streamflow.
- The interior network with an internal drainage basin, including Lake Eyasi and the Bahi depression in the north-east of the country with Lakes Manyara and Natron, covers 153,800 km2 in the Great Rift Valley.
- The “Lake Rukwa” basin and network which covers 88,000 km² in the south of the Rift Valley.
- The “Lake Victoria” basin and network which covers 88,270 km².
- The “Lake Tanganyika” basin and network which covers 151,000km2.

Figure 1. River/lake basins in Tanzania.

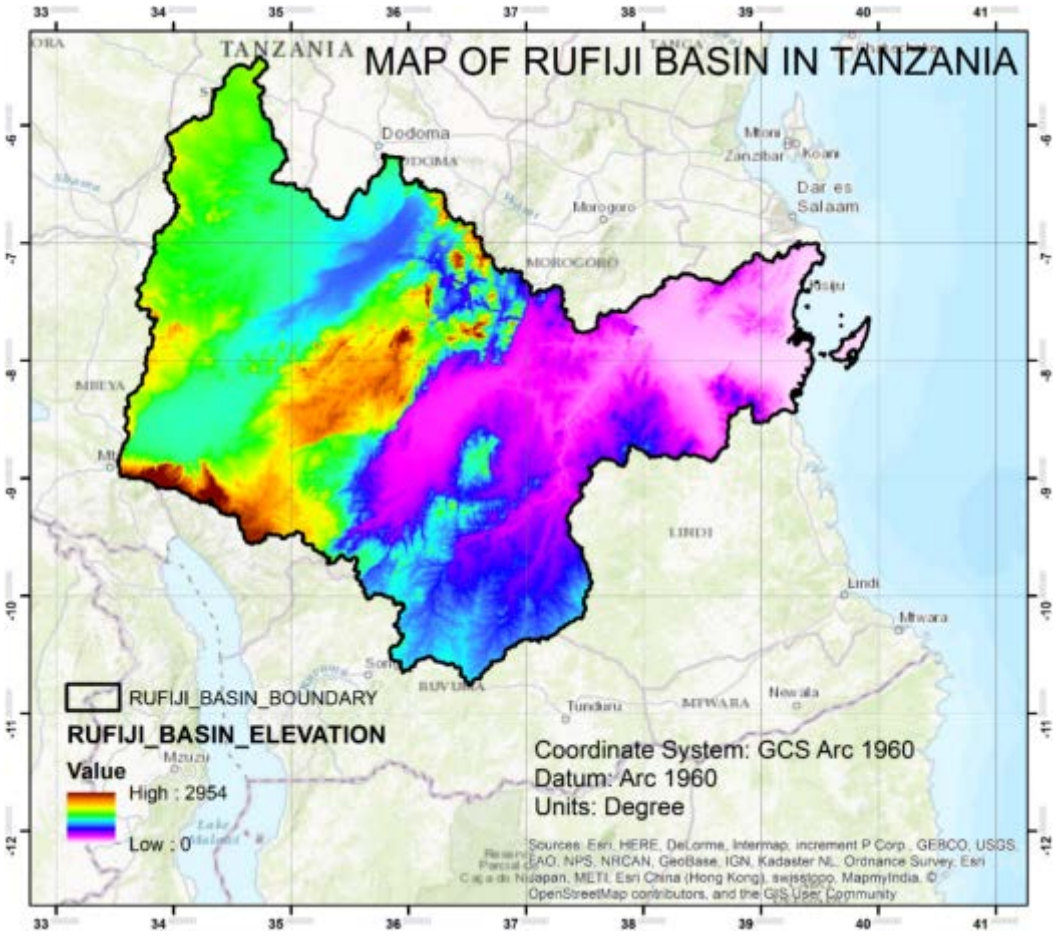


In all the nine water basins there are potential groundwater and surface water resources for social and economic activities. However, these water resources are threatened by environmental degradation, often driven by population growth, unsustainable use and by climate change (Hamisi et al., 2012). Catchment deforestation and urbanization are also contributing to the poor status of water resources and can result in conflicts between upstream and downstream water users (Kashaigili et al., 2007). Thus, the fundamental threats facing Tanzania's water basins are depletion and degradation of water resources to the level that they can no longer cope with ever rising demands (Mwakalila 2008).

2.2. The Rufiji River basin

The Rufiji River drains into the Indian Ocean and its basin covers an area of approximately 177,000 km^2 (approximately 20 % of Tanzania) (Figure 2). The altitude of the basin rises from 0 m above mean sea level (mamsl) at the Indian Ocean to more than 2960 mamsl in the highlands of the Kipengere ranges and Poroto Mountains. The Rufiji River basin comprises four well defined major river sub-basins. These are: the Great Ruaha; the Kilombero; the Lower Rufiji and the Luwegu.

Figure 2. Rufiji Basin.



The Rufiji Basin extends inland from the Indian Ocean, for about 640 km and its width varies from a minimum of about 55 km in the lower parts to about 480 km in the portion above Iringa. The Basin is characterised by many different freshwater wetlands both in the highlands and the lowlands, including small natural wetlands, human-made wetlands such as rice paddies and extensive floodplain systems, such as the KVRS. At the coast, mangroves in the Rufiji River Delta form part of the Rufiji-Mafia-Kilwa Marine Ramsar Site.

The basin accommodates large areas of agricultural land, hydropower, fisheries and forestry on which communities' livelihood activities depend.

2.3. Hydrology of the Rufiji River basin

The Rufiji River Basin consists of four principal sub-basins (Figure 3). The Rufiji River, which is the largest river in the Rufiji Basin, can have maximum flows of up to 14,000 cumecs and minimum flows of about 50 cumecs in the lower catchment. The input of each sub-basin to the annual streamflow with respect to the entire basin is shown in Table 1. The Kilombero sub-catchment, whilst only representing less than a quarter of the entire Rufiji River Basin, provides almost two-thirds of the total annual run-off.

Table 1. Major rivers in the Rufiji Basin

No	Sub basin	Catchment Area (km^2)	% Drainage Area	% Annual runoff
1	Great Ruaha	83,979	47	15
2	Kilombero	39,990	23	62
3	Luwegu	26,300	15	18
4	Rufiji	27,160	15	5
Total		**177,429**	**100**	**100**

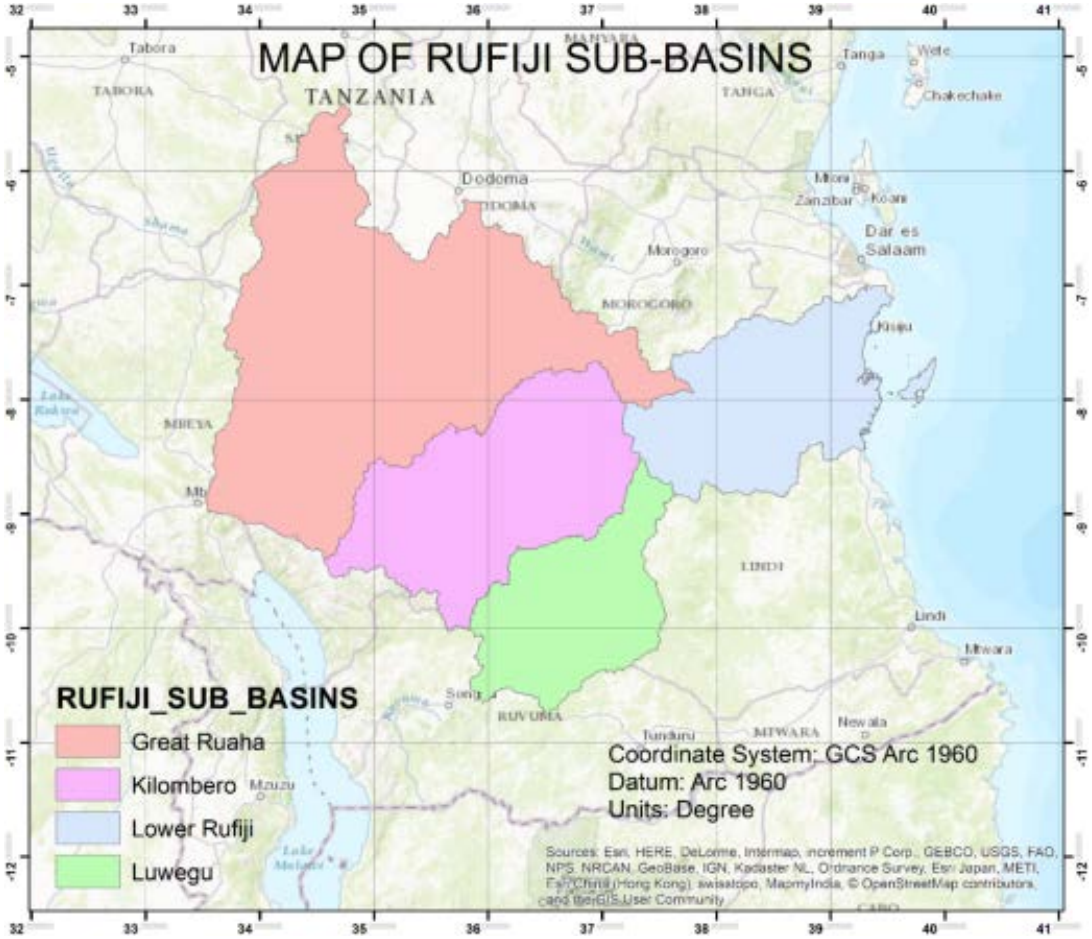
The climate in the basin varies from the coast to the highlands in the upper parts of the catchments. Except for the lower parts of the basin, which experiences two rainy seasons, the largest portion is characterized by unimodal rainfall. The average annual rainfall varies from 400mm in the drier areas to 2000mm in wetter parts.

2.4. Management of water in the Rufiji River Basin

The Government of Tanzania is currently implementing the Water Sector Development Programme (WSDP) 2005-2025 (URT, 2006). Phase I of this programme ended in 2014 and achieved interventions in four thematic areas: (a) water resources management and development, (b) national rural water supply and sanitation, (c) urban water and

sewerage, and (d) institutional strengthening and capacity building. A review conducted of Phase I indicated that the Basin Water Offices (BWO) had been strengthened by the advent of the WSDP and that progress was being made on Integrated Water Resources Management (IWRM) plans across the nine basins (URT, 2013).

Figure 3. Rufiji River sub-basins.



The authority for managing the water resources of the basin is vested in the Rufiji Basin Water Board (RBWB) as specified by the National Water Policy (NAWAPO) (2002) and Water Resources Management Act (2009). The RBWB comprises members of major water using sectors including water, energy, agriculture, manufacturing, mining, trade and environment. A technical Basin Water Officer acts as the Chief Executive Officer of the Board and is responsible for the secretariat based at the BWO. Specifically, the RBWB's responsibilities include: water resources monitoring and assessment, water allocation (issuing and management of water permits), strengthening community participation in water resources management, coordinating water resources management and development planning, water quality monitoring and pollution control, water use conflict management, and water sources protection and conservation.

A series of District Facilitation Teams (DFTs), comprising district-level civil servants, assist in the overseeing, coordination and facilitation of integrated water resource management activities across the Basin and especially at local government and community levels. Their primary role is to provide the link between the RBWB and the district councils.

Grassroots, community involvement in water resource management is primarily conducted through Water User Associations (WUAs). The functions of the WUAs are set out in the Water Resources Management Act (2009) and comprise: to (1) manage, distribute and conserve water from a source used jointly by the members of the association; (2) acquire and operate water use, groundwater, and discharge permits; (3) resolve conflicts amongst members of the association related to the joint use of a water resource; (4) collect water user fees on behalf of the Basin Water Board; and (5) represent the special interests from water used for a public purpose (such as the support of the environment or the management of a groundwater area).

Rufiji Basin Integrated Water Resources Management and Development (IWRMD) Plan

The Water Resources Management Act (2009) codified IWRM practices into law. One of the results of this has been the production of the Rufiji Basin Integrated Water Resources Management and Development (IWRMD) plan (WREM International, 2015). Through a consultative, participatory approach the IWRMD plan seeks to be an important mechanism for anchoring IWRM approaches in the river/lake basins in Tanzania, providing a framework for evaluating competing sectoral water demands, and establishing equitable water allocation among sectors.

The KVRS is poorly described and defined in the IWRMD plan. The entire Ramsar Site appears to be conflated with the Kibasila swamp, which is only a small proportion of the larger site.

Notwithstanding the possible confusion regarding the extent and ecological character of the KVRS, the diagnostic analysis presented in the IWRMD plan highlights a variety of challenges for the Kilombero floodplain area. These challenges *inter alia* highlight:

- That there are communities vulnerable to floods and droughts;
- That there is a paucity of reliable hydrological data to support evidence-based decision-making;
- There is poor regulation of water abstraction activities;
- Deforestation is widespread;
- Surface and groundwater quality is deteriorating;
- Cross-sectoral coordination and stakeholder participation in water resource management activities is weak; and

- Biodiversity and wildlife resources are under a condition of high stress.

The IWRMD plan provides assessments of the Kilombero River based on the upper reaches, categorised as the Ruhudji, Mpanga and Kihansi Rivers, and the lower reaches, the area effectively below the confluence of the Mnyera and Ruhidji Rivers and upstream of the confluence of the Kilombero River with the Rufiji River.

The findings for the Upper Reaches of the Kilombero River state that current water uses are having negligible adverse impacts on river flow. Planned hydropower schemes on the Ruhudji and Mpanga Rivers are assessed as being likely to attenuate downstream flood peaks, reduce the extent of floodplain inundation and increase the amount of viable land available for agricultural production. Climate change is also assessed and expected to reduce flows in the Ruhudji and Mpanga Rivers by between 1 and 5%.

The findings for the Lower Kilombero River indicate that under dry season conditions the current 2010-2025 water use targets will have an adverse impact on the Ramsar Site. This has important implications in relation to the planning of dry season irrigation projects. The assessment concludes that the surface water resources in this catchment cannot support the dry season water demand projections (WREM International, 2015).

With regards to water quality, the IWRMD plan reports that surface waters in the Kilombero sub-basin have poor physical quality, good chemical quality and poor bacteriological quality. The major threats to water quality identified include general catchment degradation leading to soil erosion and siltation of the rivers, contamination of shallow groundwater through human faecal matter from traditional pit latrines and isolated pollution from industrial activities across the basin.

The recommendations made in the IWRMD plan indicate the need to reduce soil and silt export from the highlands, improve the treatment of industrial waste water, improve waste water treatment for Ifakara, perform environmental and social impact assessments for all proposed agricultural schemes and to conduct full environmental flow assessments (EFAs) to ensure that adequate flow is provided at all times.

2.5. The Kilombero River sub-basin

Location and general characteristics

The Kilombero River catchment is positioned in Morogoro Region in eastern Tanzania and lies between longitudes 34.563° and 37.797°E and latitudes 7.654° and 10.023°S (Figure 4). The Kilombero River

catchment covers some 40,000 km^2 and is delimited by mountains which extend from a flat and wide plain on the southeastern side of Great Ruaha and slope abruptly down into the Kilombero Valley. To the north and west of the Kilombero Valley are the Udzungwa Mountains, and to the east, the Mahenge highlands. The peak elevation drops from an altitude of more than 1,800 mamsl to about 300 mamsl in a few kilometres, forming the broad Kilombero floodplain.

Climate of the Kilombero catchment

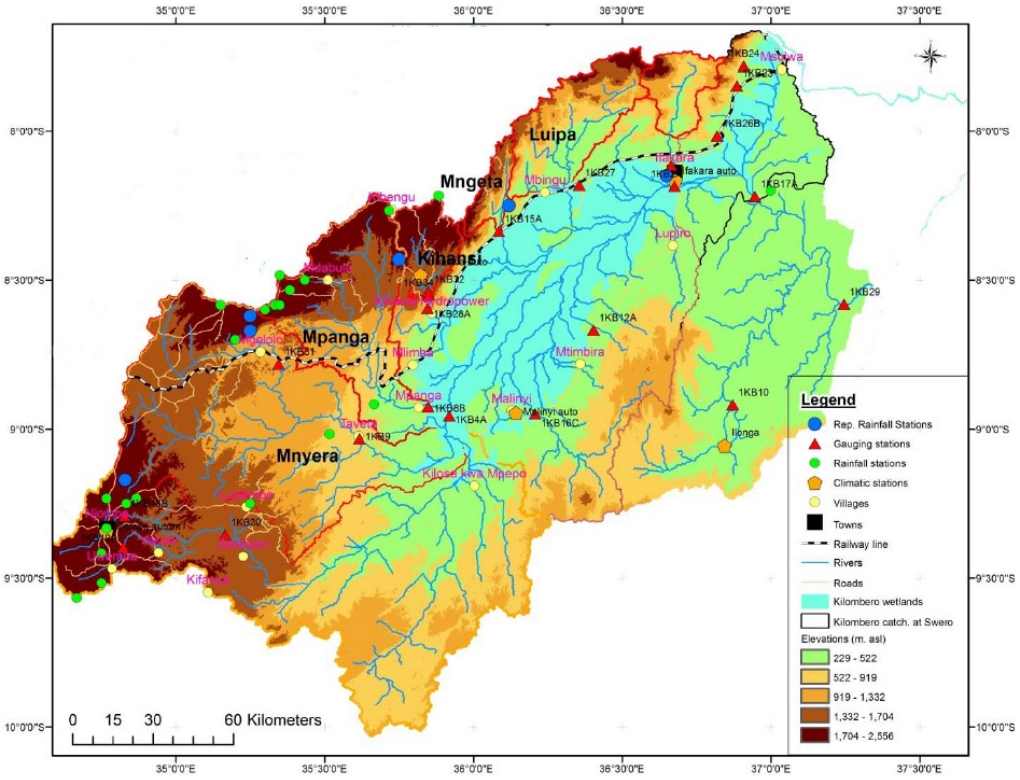
The climatic conditions in Kilombero catchment differ depending on the terrain, with the climate being more hot and humid in the lowlands. The average annual rainfall within the catchment varies from 1100 – 2100mm. The eastern Mahenge and Central Udzungwa Mountains receive high amounts of rainfall, between 1500 – 2100mm per annum, as do the low altitude southwest plains. The Kilombero plains experience annual rainfall of between 1200 – 1400mm. The rainy season is between December and April while the dry season is between June and September.

Temperature also differs within the catchment. In the Kilombero Valley, the annual mean temperature is 24^{o}C while in the uplands the annual mean temperature is 17^{o}C. December and January are the hottest months where day temperatures can exceed 27^{o}C in the lowlands and 19^{o}C in the mountains. The coldest month is July with temperatures around 14^{o}C and 21^{o}C in the highlands and lowlands respectively. In the Udzungwa Mountains, the relative humidity is between 70 – 87% whilst the lowlands experience 58 – 85% humidity. Approximated for a twelve-month period, potential evaporation is around 1800mm in the Kilombero catchment.

Catchment hydrology and drainage patterns

The hydrology of the Kilombero River catchment is determined by the terrain and climate. A number of rivers drain large watersheds that finally discharge into the Kilombero valley floodplain (Figure 4). To the north and west of the Kilombero lowlands are the Udzungwa Mountains, with the Mahenge highlands to the east. These upland areas are of the utmost importance to the hydrology of the ecosystem. The majority of the rivers in the catchment begin in the Udzungwa Mountains while the others originate in the Mahenge Mountains. Among others, the Ruipa, Kisegese, Mngeta, Mgugwe, Kihansi and Mpanga rivers flow from the Udzungwa Mountains to the west of the Kilombero plain. The Mnyera, Ruhidji and Pitu rivers drain areas to the south including the south Udzungwa and east Livingstone Mountains. The Igugu and several other smaller rivers drain into the Kilombero valley from the Mahenge Mountains to the east of the floodplain.

Figure 4. Topographic map and hydrological features of Kilombero sub-basin. (Reproduced from USAID (2015).



Upstream of Lupunga, the Ruhudji and Mnyera rivers are the two major tributaries that drain into the Kilombero valley. Downstream of Lupunga the Kilombero floodplain is characterised by anastomosing channels which comprise *inter alia* the Mpanga, Mnyera and Namingundi rivers. The Kilombero River is formed downstream of the confluence of these rivers, some 35 km upstream from Ifakara.

2.6. Governance structures in the Kilombero River sub-basin

Administrative areas

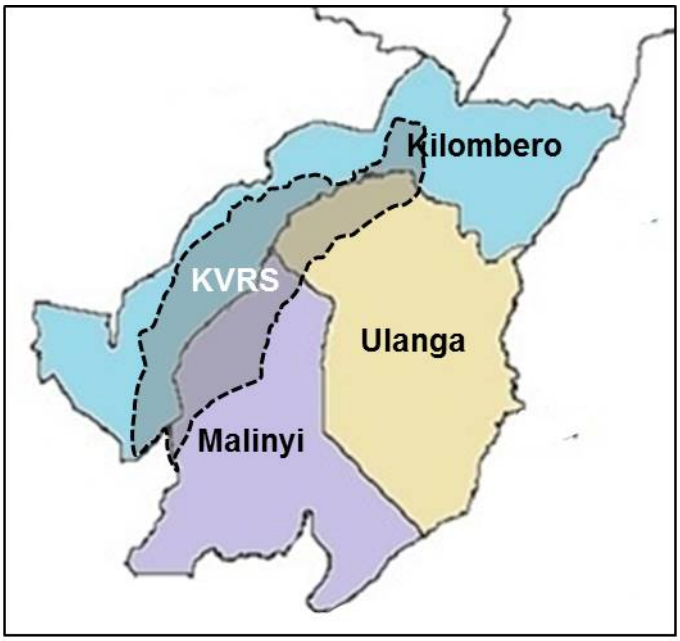
Tanzania has a multi-tier system of government: the Central Government (made up by President and different Ministries), Regional Governments and District and Local Governments. Local Governments are either urban Authorities (city, municipal and town councils), or rural Authorities (district councils). The latter incorporate small towns (township Authorities) as well as village councils. Local government is a centralized system of government with limited decision making and financial autonomy.

Local government exists in order to promote development and democracy at the district and sub-district levels of government. There are two types of local authorities: rural authorities, normally referred to as district councils; and urban authorities which include city, municipal and town councils. Hierarchically, a district council comprises wards, under

which exist village governments and finally the 10-house cell system (or vitongoji). Within an urban context, the urban council comprises a municipality (if the top structure is a city) under which exist wards, then street government and, finally, the 10-house cell system. There are no village government structures in urban authorities.

The KVRS is in the Morogoro Region and occupies a position that straddles three administrative districts: Kilombero, Ulanga and Malinyi Districts (Figure 5). Ifakara, which lies within Kilombero District, is administered by a Town Council. The National Land Use Planning Act Number 6 of 2007 requires each district to publish District Land Use Framework Plans (DLUFP). In compliance with this Act, in 2016 each of the three districts published their DLUFPs which outline how district land and land based resources could be economically utilized based on its potential and limitations to various alternative uses. The information contained within the DLUFPs is intended to assist decision-makers and planners to make sound decisions on sustainable land use planning. As such these plans should also act as an opportunity to ensure that the principles of wetland wise use are considered in strategic decision-making.

Figure 5. Administrative districts.



The three Districts are composed of many wards and villages (Table 2). Almost one hundred villages lie within or partly within the boundary of the KVRS and 16 wards have the majority of their area within the Ramsar Site. The District authorities have been working in collaboration with a range of stakeholders to develop Village Land Use Plans (VLUPs). The VLUPs are intended to provide a systematic assessment of land and water potential so that resources can be utilised in a sustainable way in

order to address the needs of the people. As of June 2016, across the three districts approximately 50% of the villages had developed VLUPs (Table 2). However challenges remain in the implementation of the VLUPs. For instance in Kilombero District it is acknowledged that none of the VLUPs developed since 2007 have been implemented.

The DLUFPs consider a range of socio-economic factors, including population change. Historical population data are considered alongside projections based on national censuses in order to predict future trends. Across the three districts the population is projected to grow by approximately 3% per annum over the next 20 years. This will effectively amount to a doubling of the current population (Table 2).

Table 2. Administrative districts and population predictions. (Data from URT 2016a, 2016b, 2016c).

District	Wards	Villages	Vitongoji (hamlets)	% with plans	Population			Rate of growth
					2012	2016	2036	
Kilombero	26	99	383	53%	407,880	475,329	1,021,657	3.9
Ulanga	21	59	222	49%	151,001	169,294	299,757	2.9
Malinyi	10	33	164	48%	114,202	128,037	226,801	2.9
Total	**57**	**191**	**769**	**51%**	**673,083**	**772,660**	**1,548,215**	

Land use

Within the three districts land can be classed under three major categories, namely village land, reserved land and general land as defined in the Village Land Act 1999.

Village land is defined as land falling within the boundaries of the registered or non-registered village and administered by the villagers themselves through their respective Village Councils and Assemblies. Village land is owned through the Certificate of Customary Right of Occupancy issued to the villagers by their respective Village Councils (URT, 2016a).

General land includes all parcels of land, which are not under reserved land, or village land and in particular these are land parcels, which the Commissioner of Lands has, issued titles. This category of the general land is made up of land in the surveyed plots, surveyed farms, total built up areas of the planned major and minor settlements or trading centres (URT, 2016a).

Reserved land refers to all land that is reserved under any law. The reserved land includes Forests Reserves, Game Reserves, National Parks, road reserves, wetlands, land reserved for public utilities, water source

reserves and land declared as hazardous land, all of which types of land exist in the district (URT, 2016a).

Table 3. Land uses in the three districts. (Data from URT 2016a, 2016b, 2016c).

District	Total area (ha)	Village land	General land	Reserved land	KGCA
Kilombero	1,491,800	595,245.65	142,542.50	754,011.83	174,908.53
Ulanga	1,068,889	311,714.59	252,216.78	504,958.06	31,863.32
Malinyi	1,111,173	164,222.34	474,501.60	472,449.91	22,335.95

In Kilombero District approximately 50% of the land is reserved land and less than 10% is general land. Malinyi District has about 85% of the land split evenly between general and reserved land, whilst in Ulanga District the majority of land is reserved land (approximately 47%) (Table 3). Of the reserved land, the Kilombero Game Controlled Area (KGCA) covers about 5% of all the district land, with the majority of the KGCA being in Kilombero District.

2.7. Economic activities

Within the Kilombero River Basin there are numerous economic activities which contribute to both the local and national economy. However, over the last 20 years the economic activities and the associated human disturbances within the Kilombero Valley have severely impacted upon the ecological value of the area (ERM, 2012; Ntongani et al., 2014).

Agriculture

Nationally agriculture accounts for 25% of GDP and at a local level it can account for three quarters of the income to individual rural households (ERM, 2012). Within the Kilombero valley, and inside the KVRS, a range of agricultural practices and systems are present. Cash crops grown in the Kilombero valley include rice, maize, peas and bananas while sugarcane, sesame, sunflowers, rubber and cocoa are grown for commercial purposes (Nindi et al., 2014).

The presence of fertile soils, supported by the delivery of nutrients from the annual flood pulse (Ntongani et al., 2014), has made the KVRS conducive to agricultural production. Agriculture has utilised both rain-fed and irrigated approaches resulting in subsistence and surplus production (Musamba et al., 2011). Agricultural intensification has been implemented widely. For instance, fertilisation through the use of urea, cow manure or green manure has been used to enhance rain-fed rice yields (Kwesiga et al., 2016) and commercial sugarcane production has

expanded within the Kilombero valley in area from 3,500 ha in the 1990s to 15,000 ha in 2014 (Sulle, 2016). However, whilst commercial farming is present, the majority of crop production is undertaken individually, or in small private farms, with an average holding of approximately 1 ha (Mombo et al., 2011).

[redacted] Unsustainable agricultural expansion has been implicated in impacts of the wildlife values within the KVRS (Haule et al., 2002). Agricultural encroachment into the KVRS has also been identified by local communities and stakeholders as one of the main causes for environmental degradation within the area (Munishi et al., 2012).

[redacted] As part of the GoT's efforts to enhance food security, reduce poverty and vulnerability to climate change, a strategic approach has been developed to foster agricultural growth. The Southern Agriculture Growth Corridor of Tanzania (SAGCOT) programme is a public-private partnership that aims to achieve rapid and sustainable growth across a corridor of land stretching from Dar es Salaam through Morogoro, Iringa and Mbeya to Sumbawanga near the border with Zambia and includes the KVRS (URT, 2013a). Over the coming 20 years, the SAGCOT programme aims to bring 350,000 ha of farmland into commercial production, to increase annual farming revenues by US$1.2 billion, and to lift more than 2 million people (roughly 450,000 farm households) out of poverty.

[redacted] As a guiding principle, it has been proposed that SAGCOT activities should contribute to sustainability rather than undermining it (URT, 2013a). Through an adoption of the concept of Agriculture Green Growth (AGG), agricultural productivity under the SAGCOT programme should seek to be profitable whilst protecting and restoring the environment. Therefore sustainable approaches, such as the wise use of wetlands, should be wholly compatible with the scope of the SAGCOT programme.

[redacted] However, without appropriate planning and management, there remains a risk that the SAGCOT programme will repeat agriculture-related mistakes already made in the Kilombero Valley, with potentially serious risks to the sustainability of the benefits generated (ERM, 2012). Consequently, due to the desire to achieve sustainable accelerated agricultural development and the risks of irreversible negative impacts to critical habits, ecosystem services and downstream water users, the Strategic Regional Environmental and Social Assessment (SRESA) recommended that any large-scale irrigation schemes within the Kilombero Valley should be temporarily suspended until there is a comprehensive understanding of their impacts (URT, 2013a). Similarly, the SRESA calls for a strategic plan for the protection and restoration of ecological values for the benefit of wildlife and local communities. Such approaches are commensurate with a risk-based, strategic management

approach advocated by the Ramsar Convention (Ramsar Convention Secretariat, 2010).

As part of the SAGCOT initiative, work has been conducted through the United States Agency for International Development (USAID) to investigate environmental flows associated with possible irrigation schemes within the Kilombero River sub-basin (USAID, 2015; USAID, 2016). The environmental flow assessment (EFA) focussed on five selected study sites that were considered most vulnerable to the downstream impacts of four irrigation schemes (Kisegese, Udagaji, Mgugwe, and Mpanga-Ngalimila) under consideration for development along the northern margin of the Kilombero River Valley. The GoT's plans for these schemes originally called for 40,000 ha of paddy rice to stimulate economic growth in the region.

The EFA concluded that impacts on river flows and associated eco-hydrology were expected to be greatest in the reaches immediately downstream from the proposed schemes. However, the limitations imposed by historical data reliability and the use of a single six month season are clearly acknowledged and are considered to introduce a degree of uncertainty in the results (USAID, 2016). This was considered to be a particular challenge for the river-floodplain wetland reaches assessed where hydraulic modelling was limited to the main channel-riparian corridor zone. The final report acknowledged this challenge, and that, whilst the results had some utility, stated that "it was impossible to investigate the full complexity of flooding patterns on the floodplain" (USAID, 2016). In order to improve the understanding of these issues, the final report recommended that additional attention should be given to increasing knowledge of flow and flood relations to ensure that the most socially and ecologically significant floods are maintained in the basin.

The EFA highlighted several vulnerabilities across the Kilombero River system, and in particular in the vicinity of the margins of the KVRS. It was recommended that on the main stem of the Kilombero River that monthly environmental flows should be 82.3% of mean annual flow during the years when sufficient water is available (during drought years a higher percentage would be required) (USAID, 2016).

USAID (2016) recommends that clear and understandable communications of the outputs of the EFA are required to ensure unnecessary conflicts among the various interest groups across the basin are avoided. Furthermore, it is considered important that the results of the EFA are linked to and integrated with the multiple levels of planning and regulations to ensure sustainable use of Tanzania's water resources.

The EFA was relatively focussed in its application, with an emphasis on five study sites and four irrigation schemes. It is clearly acknowledged that there is a need to place the results of the EFA conducted on the Kilombero River to be placed in the context of the downstream Lower Rufiji Basin for which no EFA has been conducted.

Livestock

The livestock population within the KVRS has been increasing over time and is now seen as a major economic activity (URT, 2013a). The pastoralists come in search of grazing land, primarily due to pressures elsewhere. Locally this has resulted in conflicts with villagers, especially with regards to damage to crops. Furthermore, the increased number of livestock has also been implicated in the significant reduction in the population size of other mammals, including elephant, puku and buffalo, through both disturbance and competition for grazing (Bonnington et al., 2007). In addition to direct impacts on wildlife, the increased number of livestock has also been responsible for soil degradation and compaction, altering the eco-hydrological character of the floodplain area (Mombo et al., 2011).

One response of the Government of Tanzania to the livestock issue has been through enforced evictions, such as those enacted in 2006 and in late 2012 to early 2013, with this later eviction reportedly removing 280,800 cattle out of the Kilombero Valley (IWGIA, 2016). Notwithstanding question marks over the sustainability of this approach, serious concerns have been raised with regards to corruption and human rights violations associated with the enforced evictions (PINGO's Forum, 2013; IWGIA, 2016).

Fishing

Fishing is one of the most important economic activities in the KVRS. The fisheries resources of the Kilombero Basin are a source of cheap animal protein for the population, support livelihoods and income for the fisherfolk and provide a source of revenue to Local Government Authorities (URT, 2013a). Degradation of the wetlands, and in particular negative changes to breeding grounds, has resulted in impacts on the fisheries resource and commensurate impacts on the well-being and livelihoods of local people (Mombo et al., 2011). This was also indicated by local fisherfolk during consultations held as part of the RAM. However, a recent analysis conducted based on qualitative evidence as part of the KILORWEMP suggests that whilst individual catches may be declining, total catches may not be. Similarly, fish may not be getting smaller but more small fish are being caught (KILORWEMP, 2017).

Forestry

Across the wider Kilombero River sub-basin forestry, both planted and natural forests, is important for a range of products including honey,

wax, timber, pulp and paper. The forests are managed by both government institutions and private companies. Within the KVRS, the Kilombero Valley Teak Company (KVTC) owns approximately 28,000 ha of land arranged in several teak stands ranging from 9 to 100 ha set within a mosaic of natural vegetation (Bonnington et al., 2010; Mombo et al., 2011).

Industry

Isolated industrial interests are present in the Kilombero River sub-basin. Industrial concerns include timber processing and agro-based operations.

Extractive industries

Swala Oil and Gas (Tanzania) Plc are currently exploring the potential to develop possible oil and gas reserves in the Kilosa-Kilombero licenced area.

Tourism

The Kilombero Valley has been a prominent tourist destination with regards to hunting. Four hunting blocks effectively covered the KGCA. However, in 2011 only two hunting blocks were active (TAWIRI, 2011). Wider tourism activities are limited in their scope and extent.

Other activities

There several local economic activities present across the Kilombero River sub-basin. These include *inter alia* brick making, the harvesting of traditional medicines and non-timber products such as honey (Balama et al., 2016).

3. Maintaining the ecological character of the Kilombero Valley Ramsar Site

3.1. Overview

People in the Kilombero valley are heavily dependent on the abundant natural resources - wildlife, forests/woodlands, fisheries, grazing land and water for agriculture and human consumption (Mombo et al., 2011). The natural resources of the Rufiji basin, and in particular the Kilombero River sub-basin, are under growing pressure due to population growth, agriculture intensification, uncoordinated and fragmented land use changes, unsustainable demand for grazing, and the economic, social and environmental changes taking place at the local, national and international levels. All of these factors have the potential to influence the ecological character of the Ramsar Site.

3.2. Current management of the KVRS

The responsibility for the management of the KVRS lies with the Wildlife Division (WD) within the MNRT. Overall responsibility for the implementation of the Ramsar Convention within the United Republic of Tanzania rests with the VPO.

About 7,000 km^2 of the valley were designated as a Game Controlled Area (GCA) in 1952. The GoT designated part of the KGCA and areas of the contiguous land as a Ramsar Site in 2002. Biodiversity (wildlife) conservation functions and the control of hunting are provided by the Wildlife Division of MNRT under the Wildlife Policy 2009 and the Wildlife Conservation Act No. 5 of 2009. This has resulted in a control of hunting within the KGCA but not to wider conservation delivery (KILORWEMP, 2016).

The RAM ToRs stress that the management of complex wetlands sites, such as KVRS, faces several critical capacity bottlenecks both locally and in the broader national context. These include regulatory gaps and conflicts among resource users and stakeholders. In addition, the effectiveness of traditional conservation services is questioned in face of more complex and conflicting social dynamics and demands for access to land and weak governance. The present GoT agenda through MNRT and VPO is to preserve the KVRS with a core protected area (GCA). However, its management and regulatory framework needs to be strengthened if this is to be achieved. The tools and frameworks of the past may no longer be adequate to manage the pressure and challenges of today and of the future.

Wetland issues are partly covered by existing laws but the coverage is somewhat fragmented. There are large gaps and many provisions are not comprehensive. Key legislation (such as that covering agriculture, for example) does not specifically mention wetlands and there are contradictory regulations regarding wetlands in land and water legislation. The tools for protection and sustainable management in current legislation (such as the Wildlife Conservation Act (2009) and the Environment Management Act (2004)) are not flexible enough to cater for the diverse needs of protection and management of wetlands according to the wise use principle. There is thus a need to find specific solutions, to test and pilot more refined tools, and eventually to incorporate new models into the legislation.

Another important issue with the current legislation is that the environmental regulations remain widely unimplemented and the resources to enforce regulations are not available. That said, the lack of an overall legal and policy framework for wetlands leaves government

bodies at all levels with highly inadequate tools to effectively manage wetlands in a sustainable manner.

During the Sustainable Wetlands Management Programme (SWM), wetland management had a reasonable profile in Tanzania (URT 2012) and a wetland-specific policy reform process was initiated (KILORWEMP, 2016). Subsequently, the profile of wetland management has significantly dwindled for a number of reasons, including: patchy impacts and sustainability of the SWM programme outcomes, especially with regard to policy level impacts and institutionalization of measures and mechanisms; strongly reduced donor support with DANIDA phasing out and BTC supporting site management and limited policy development via KILORWEMP (joined by European Union (EU) co-funding at a later stage); unclear mechanisms of coordination between the Ministry of Natural Resources and Tourism (MNRT) and the Vice President's Office (VPO); momentum within the Wildlife Division being overridden by other priorities of wildlife conservation, and transition towards establishing a wildlife management parastatal.

A major issue identified during the RAM was the overlapping and often conflicting management responsibilities and regulatory authority for the KVRS and its adjacent land areas. While the MNRT/WD have responsibility for the core KGCA; other parts of the KVRS area are managed by:

- Village Councils reporting to three different District Councils and ultimately to the VPO;
- Village Forest Reserves managed by village councils;
- Forest Reserves/Nature Reserves managed by the Forest and Beekeeping Division of MNRT;
- Teak plantations leased to the Kilombero Valley Teak Company;
- the Iluma Wildlife Management Area managed by MNRT/WD;
- Mbuti and Gunda Beach Management Units managed by Min. of Agriculture, Livestock and Fisheries;
- Selous Game Reserve managed by MNRT/WD ;
- Irrigation schemes leased to various private and public sector operators;
- Chita National Service land;
- Kibasira Prison managed by KPL and
- Ifakara urban area managed by its city council.

The cross-sectoral nature of wetland management poses a continual challenge for appropriate management and planning. Essentially, wetlands are large interlinked water systems, which do not follow administrative or political boundaries as demonstrated above.

Furthermore, elements of their ecological character (such as water, wildlife, tourism, agriculture, etc.) are not under the purview of a single government ministry or department. However, management interventions upstream in one administrative area or undertaken by one government sector may have significant impacts on the integrity and function of a wetland downstream in another district or region. The negative downstream effects of the diversion of water will often only be acknowledged much farther downstream and will often be the result of many minor cumulative diversions. Furthermore, the hydrological impacts of cumulative changes may not be immediately apparent and sometimes are only observed when a significant change in the ecological character has occurred. Overall planning is currently almost limited to a compilation of lower level planning and thus integration of wetland issues into the spatial and sectoral planning of districts and regions needs to be further developed. The river basin management approach evolving through the IWRMD plan should help to address the problems in a more coordinated and comprehensive manner if the recommendations are appropriately implemented.

The Ramsar Convention has adopted guidelines on integrating wetlands into river basin management planning and in undertaking EFAs (Ramsar Convention, 2008). Assessments have been conducted in this regard in Tanzania, but the implementation of the river basin approach and the integration of the ecological functioning of the wetlands of the Kilombero Valley within these processes still poses significant challenges.

Despite some recent advancements (for instance Mombo et al., 2011; Munishi et al., 2012), there is insufficient awareness of wetland values and functions at all levels of government and within society as a whole. Similarly, the difference between the KGCA and the KVRS is often not clear to local stakeholders (KILORWEMP, 2016). These ambiguities are partly because of the limited knowledge base as to what constitutes a wetland but also because certain sectors of society regard wetlands as unproductive wastelands, unless drained or otherwise modified for agricultural production or some alternative land use. A change in the perception of wetlands is still needed to ensure that wetland values are integrated into decision-making.

In order to address some of these concerns and to improve the management of the KVRS, the KILORWEMP project has proposed recommendations that aim to guide the consolidation of the Kilombero Game Controlled Area (KGCA) as part of the Kilombero Valley Ramsar Site (KVRS) (KILORWEMP, 2016). The emphasis of this approach, as clearly stated in the conclusions and recommendations of KILORWEMP (2016), is primarily on the consolidation of the KGCA. The six options presented focus on differing approaches to consolidating the KGCA. No similar option-analysis is provided for the Ramsar Site. Rather, an

integrated management plan (IWP) is proposed for the KVRS. However, work is on-going in order to better understand the requirements and options for broader wetland management (KILORWEMP, 2016).

Nevertheless, the KILORWEMP project has clearly acknowledged the fact that 'traditional protected area management and law enforcement are necessary but not sufficient to preserve the wetland' (KILORWEMP, 2016). Given the rapid change in land use and the virtual extinction of large mammals, pursuing the protection of the remainder of the valley floor should focus on conservation of the wetland and hydrological values of the site.

3.3. Human induced change

Background

At the time of designation in 2002, several factors were identified within the Ramsar Information Sheet as affecting the Ramsar Site's ecological character. These factors included, but were not limited to:

- The creation of some 15,000 ha of commercial rice agriculture by private company, Kilombero Holdings Ltd.
- The conversion of an area of some 6,000 ha in to rice agriculture by Idete and Kiberege Prisons.
- The creation of some 500 ha of rice agriculture by a private Canadian company near Mofu.
- The planned extension of other commercial rice or maize farming activities.
- Sale of the Kalunga Forest Reserve for conversion to a rubber plantation.
- The creation of teak plantations by the Kilombero Valley Teak Company (KVTC).
- Impacts from the adjacent sugar plantations north of the Ramsar Site.
- The impact of upstream hydro-electric power generation projects.
- The ineffectiveness of the designation as a Game Controlled Area (GCA) as a method for securing the conservation status of the Site as regulation is limited to hunting.
- The increased number of cattle grazing on the floodplain.
- Clearing of forests in the wider catchment and the resultant changes in hydrology within the Kilombero River and valley.
- Poaching of wildlife.

Knowledge of pressures

In conducting the RAM, it is clear that many of the issues identified in 2002 remain relevant in 2016. Therefore the knowledge of these issues has been in place for more than a decade. As such, it would be reasonable to expect the Government of Tanzania and other organisations to act in a

positive manner to ensure that human-induced negative changes to the ecological character of the KVRS were prevented.

As can been seen from the Ramsar Information Sheet for the site and from the plethora of reports and publications, a great deal of information and knowledge exists on the nature, intensity and magnitude of pressures affecting the wetlands within the Kilombero Valley. Most of this knowledge has been in place for more than a decade.

The RAM has considered a range of approaches and sources of information in order to evaluate possible changes in the ecological character of the KVRS. These include: publications provided to the RAM team by the KILORWEMP project; independently sourced peer-reviewed journal articles, grey literature and reports; direct field observations; consultation with a range of stakeholders; outputs from the consultation workshop; and their professional expert opinion.

3.4. Pressures on the ecological character

Impacts on wildlife

The TAWIRI aerial surveys of the greater Selous ecosystem have monitored larger mammal populations in the Kilombero Valley since 1986 and have recorded a steady decline in almost all species over the last 30 years (TAWIRI, 2011). The most dramatic declines have been in the dry season counts where elephants historically migrated into the Kilombero Valley from the Selous Game Reserve. In the 1986 dry season count there were an estimated 5000 elephants in the Kilombero Valley but in the recently completed dry season count in 2015 there were no elephants counted in the Kilombero. Interviews conducted during the RAM indicated that elephants are very rarely observed in the Kilombero and those that are observed are transiting through the valley from surrounding wildlife areas. It has been stated that there is a virtual extinction of large mammals in the Kilombero Valley (KILORWEMP, 2016).

Similar declines have been recorded in what was, at the time of Ramsar designation, the world's largest population of puku (a stable population of 50,000 to 60,000 puku were recorded during the TAWIRI surveys from 1989 to 1998). Unlike the elephants the puku were permanent residents of the Kilombero wetlands but the limited number of the puku currently in the valley have sought refuge in the miombo woodlands south of the KVRS according to the surveys carried out by the KILORWEMP team and the population within the KGCA is effectively zero (I. Games, *pers. com.)*.

The functional role that the KVRS plays as a wildlife corridor has been severely compromised (Jones, 2012). The various human activities, such

as intensification of agriculture and increases in the numbers of livestock, have been implicated in the impacts to the large mammal populations (Bonnington et al., 2007).

A study published in 2012 reflected many of the observations captured in the RIS, stating that the main causes of degradation of the Ramsar Site were agriculture, settlements, illegal fishing and destruction of fish breeding sites, wildfire, poaching, deforestation and overgrazing by livestock (Munishi et al., 2012). A study of bird species composition and diversity in the Kilombero Valley concluded similarly that is recommended that anthropogenic disturbances such as fire, agriculture and cattle grazing be reduced greatly in order to restore and conserve the biodiversity of the area (Ntongani & Andrew, 2013).

On a local scale, a more recent report produced by the Kilombero Valley Ornithological Centre on activities in the Iluma Wildlife Management Area (WMA) highlighted the on-going degradation of the KVRS through cattle grazing, illegal fishing, unregulated farming and cultivation, encroachment of informal settlements, poaching of wildlife, illegal tree felling and poaching of honey (KVOC, 2017).

The work of the KILORWEMP project has further confirmed these historical and current wildlife-related issues. A report produced in 2016 following consultation with stakeholders similarly observed the extensive habitat destruction as a result of human activities, and inactivities in the case of poor regulating and planning, across the valley (KILORWEMP PIU, 2016).

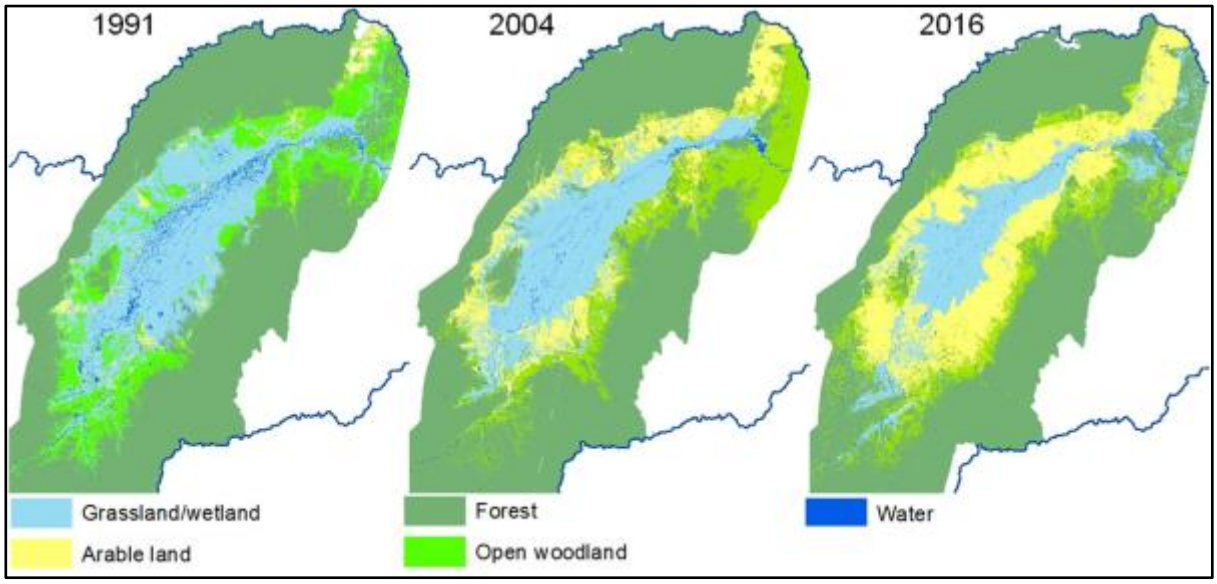
Land use change

Numerous sources, including earth observation data and ground observations, indicate that land use patterns across the KVRS have changed significantly over time. Based on interpretation of earth observation data, Figure 5 demonstrates the scale and rate of land use change within the Kilombero Valley since 1991 (Muro et al. 2017). Large areas that were formerly classed as wetland or grassland have been converted to arable land. Whilst some of the converted land still experiences inundation, it will have lost many of the functional characteristics of a wetland, for instance the unique soil properties or hydrophytic vegetation (Verhoeven and Setter, 2009) and as such it can no longer be considered to be a wetland.

Using the information in Figure 5, it is possible to generate a broad estimate of the rate of wetland loss in the Kilombero Valley since 1991. It should be noted, however, that the estimates provided below are not based on the empirical data used to derive the maps and should be considered as simply providing a broad evaluation of the magnitude of

change. Future verification and publication of more accurate and complete estimates will be provided by SWOS in due course.

Figure 5. Land use change in the Kilombero Valley 1991-2016. (NB Reproduced from Muro et al. (2017). All data is provisional and should not be cited further.)

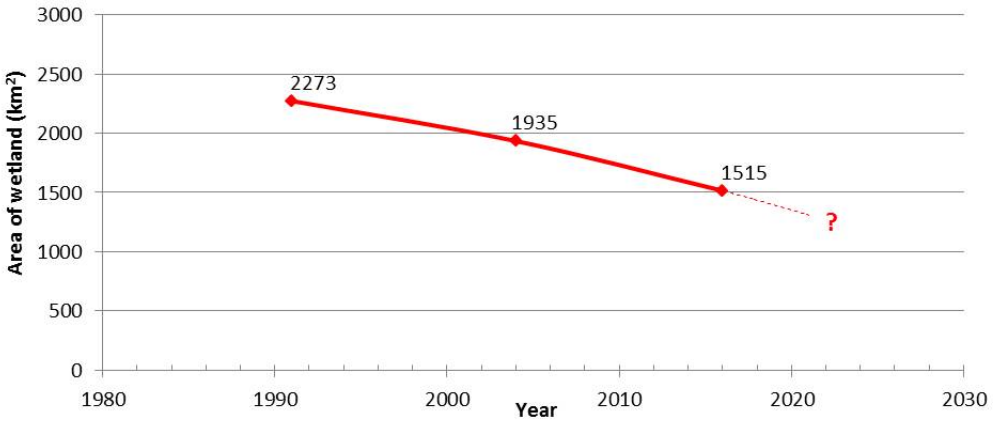


The broad estimates suggest that since 1991 the area of wetland/grassland in the Kilombero Valley has decreased from approximately 2,273 km^2 to 1,935 km^2 in 2004 to an area of 1,515 km^2 in 2016 (Figure 6). This suggests that the rate of change has increased from 26 km^2 per annum between 1991 and 2004, to a rate of change of approximately 35 km^2 per annum between 2004 and 2016. Significant interventions are required to slow and ultimately stem this rate of wetland and grassland conversion. Such concerns regarding the conversion of wetlands and native grassland to agricultural land are not new and have been raised previously in various sources (for instance Haule et al., 2002; Jenkins et al., 2002; Kangalawe and Liwenga, 2005).

Field-based and aerial investigations undertaken by the RAM team provided further insights into the nature, scale and magnitude of the various pressures on the KVRS. The observations made from the air and on the ground reinforced the conclusions of the earlier studies and reports.

Under the auspices of the SAGCOT programme, which proposes that SAGCOT activities should contribute to sustainability rather than undermining it (URT, 2013a) the unsustainable conversion of wetland and native grassland should be controlled. However, if this principle is not adhered to then the continued conversion of wetlands to arable land is likely to persist, or even accelerate.

Figure 6. Land use (wetland/grassland) change in the Kilombero Valley 1991-2016. (NB Reproduced from Muro et al. (2017). All data is provisional and should not be cited further.)



On a local scale, the RAM team clearly observed evidence of wide-scale burning and clearing of land for agriculture, intensification of agriculture through the use of tractors as opposed to the traditional hand hoe and overgrazing of vegetation and compaction and erosion of the soil within former wetland areas, supporting observations made in the published literature (for instance Mombo et al. 2011). These changes will influence the sediment dynamics associated with the flood pulse and the loss of wetland cover across the KVRS (Richards et al., 2002; USAID, 2016), increase soil compaction as grazing densities increase (Jansen and Healey, 2003), locally reduce infiltration rates and the recharge of shallow groundwater resources (Castellano and Valone, 2007) and result in losses of soil carbon (Verhoeven and Setter, 2009).

Of particular note is the potential loss of soil carbon arising from the progressive degradation of the wetlands, and especially their soils through over grazing, compaction and intensification through the use of motorised equipment, and the implications that this has on both the commitments that the GoT made in October 2016 under Paris Climate Change Agreement under the United Nations Framework Convention on Climate Change and net costs to the nation of failing to address climate change impacts. These net costs have been estimated to be in the region of 1 to 2% of GDP per annum (URT 2015).

An initial estimate has been conducted on the annual loss of carbon (expressed in CO_2 equivalents (CO_2e)) from the wetland soils of the Kilombero Valley. This assessment has been based on the estimated rates of wetland loss presented above and on published data on similar soils (Birch-Thomsen et al. 2007) and wetland vegetation communities (Saunders et al. 2014). The estimates of loss of carbon have been compared against the intended nationally determined contributions

described in URT (2015) of reductions in GHG between 10-20% by 2003 against a business as usual scenario of 138 to 153 $MtCO_2e$ gross emissions. This translates to a reduction in GHG of between 0.98 and 2.19$MtCO_2e$ per annum (assuming a time period between 2016 and 2030).

The annual loss of carbon, based on typical storage values in the top 0.5m of soils associated with the Kilombero Floodplain wetland areas ('Mbuga' soils) and assuming near total loss (as observed in heavily degraded areas during the site visits), could be between 0.31 and 0.57 $MtCO_2e$. This equates to between 14.4 and 57.3% of the total target reduction described in the intended nationally determined contributions (depending on the rate of wetland loss and whether a 10 or 20% reduction against business as usual is achieved). The values are higher when above and below ground carbon values are considered based on papyrus swamp wetland communities. For this type of wetland system, which, based on field observations and consultation with local villagers, was known to extend beyond its current extent within the Ramsar Site, the annual loss of carbon could be between 0.14 and 0.91 $MtCO_2e$. This equates to between 6.4 and 92.4% of the total target reduction.

Even taking the most optimistic case of 6.4% of the target annual reduction in CO_2e, this year on year loss of would have to be compensated for elsewhere, for instance in changes in the transport or energy generation sectors just for the status quo to remain the same.

It should be noted that this initial assessment has not considered a total balance of greenhouse gas emissions (GHGs), as the conversion of wetland to arid, degraded soil will change the emissions of methane in particular. However, Mitsch et al. (2012) demonstrated that over a long-time period that most wetlands, and especially those in tropical and sub-tropical regions, are net radiative sinks with regards to their ability to balance carbon sequestration and methane emissions.

Hydrological change

Agriculture is the main water user with regards to abstractions from the Kilombero River however there are limited large-scale abstractions and the flows can still be considered 'near natural' (USAID, 2016). Notwithstanding this assessment, the EFA also concluded that an overall negative trajectory of change in the longer term was observed at all the study locations. This trajectory of negative change was observed for hydrology, geomorphology, fish, macroinvertebrates and social elements of the Kilombero River.

The freshwater resources within the wider Rufiji Basin are already vulnerable to drought stress and therefore a range of coping strategies, including the use of drought tolerant crops and rationing of irrigation

water, will be required to address issues relating to water shortages and changing hydrodynamics (Kangalawe et al., 2011). In addition, the hydrology of the Kilombero River is expected to change as a result of climate change with flows expected to be reduced in the Ruhudji and Mpanga Rivers by up to 5% (WREM International, 2015).

The dependence on irrigation for increased agricultural production as proposed as part of the SAGCOT initiative will need to take on board the clear recommendations of both the EFA work (USAID, 2016) and the wider IWRMD plan conclusions (WREM International, 2015) in order to avoid adverse impacts on the KVRS.

Furthermore, the two major studies (EFA and IWRMD plan) conducted on the water resources raise the issue of data reliability. For instance, most of the Kilombero Sub-Basin is ungauged, including several tributary inflows to the Kilombero River and floodplain wetland. Most streamflow gauging data for the few stations with observed records are from the period from the 1950s and 1960s until the late 1970s to early 1990s. There are no reliable more recent data to characterize the present-day flow situation (USAID, 2016). Therefore a note of caution should be place on both the pedigree of the results being promulgated and also the accuracy of the predictions being proposed.

Consequently, given the issues around data reliability and the general consensus that the overall trajectory of hydrological-associated change is negative, a precautionary approach should be adopted towards water resource decision-making.

Population change

The area around the KVRS is predicted to experience a doubling of the human population over the next 20 years. It has been demonstrated that within Tanzania population growth results in environmental degradation (Madulu, 2004). Currently, the trajectory for social aspects related to water resource management is considered negative (USAID, 2016) with increased population pressures this trend is expected to accelerate. Evidence has demonstrated within the Kilombero Valley that increases in population are currently impacting both the native vegetation and the fish populations (Monson, 2012).

The spatial and development planning framework, which is well advanced in Tanzania through the DLUPFs and village planning approach, needs to consider fully the implications of population growth and the impacts on the natural resources of the KVRS in order to mitigate future negative impacts. There also needs to be strong collaboration with the governance structures within the IWRMD plan, such as through DFT and WUAs, to ensure that a joined-up and holistic approach is delivered.

Pressures described by the consultation workshop

[redacted]The report from the RAM Workshop convened in November 2016 further reinforced the fact that the Ramsar Site was subject to multiple direct and indirect pressures which were contributing to a negative, human-induced change in the ecological character of the wetland (Annex 8.7). The workshop identified the following range of challenges that need to be tackled in a coordinated and cross-sectoral manner if the future of the KVRS is to be secured:

- Addressing the reduction in flow rate and the decrease in the extent and duration of flooding.
- Water pollution.
- Uncoordinated institutions.
- Determining and defining wise use activities.
- Understanding the impacts on the wetland of climate change and also the role of the wetlands in mitigating climate change.
- Translation of information and knowledge into action on the ground.
- Implementation of integrated land use policies and plans across the wider catchment.
- Management of livestock and cessation of overgrazing.
- The lack of an adopted wetland policy and the paucity of cross-sectoral integration.
- Weak enforcement and lack of resources.
- Deforestation across the catchment.
- Population pressures.
- Conflicts associated with the lack of clarity regarding land tenure status.
- Competing government objectives especially around conservation of natural resources and agricultural practices.
- The inability to capture traditional uses in decision-making.
- Lack of land use plans and poor enforcement where plans do exist.
- Uncontrolled fires.
- Severing of wildlife corridors.
- Lack of spatial coordination of activities across the Ramsar Site.
- Political interference.

[redacted]In addition to these direct challenges and threats the participants also considered the implications of inaction and trajectory of degradation that the area is currently experiencing. If the poor level of enforcement and the limited joined-up implementation of the existing policies are to stem and reverse the negative change in the ecological character of the Ramsar Site then it was widely agreed by the participants that urgent action was required.

3.5. Pressure-response model for changes in the ecological character

The synthesis of the multiple evidence sources indicate that the Ramsar Site continues to be degraded as a result of both direct and indirect pressures (Figure 7). The direct pressures are well known and include many of the issues identified above such as burning of woodland and papyrus, intensification of the cultivation of wetland soils, grazing, consumptive and non-consumptive tree clearance, impacts to fisheries, water abstraction, urbanisation and development of settlements and resource exploitation through extractive industries such as oil and gas. All of these direct pressures can result in a change of land use, hydrology or ecology and /or a negative alteration of the ecological character of the Ramsar Site.

Often the change in land-use is incremental and sequential. Initial burning of woodland (non-consumptive use) or felling for timber or fire wood (consumptive use) opens land up for cultivation. Cultivated crops such as maize or vegetables may then be grown, cattle can graze the open land or settlements can become established. Over-grazing or unsustainable cultivation can then result in a complete depletion of the sward and the exposure of bare soil to erosion.

Often the change in the ecological character of the KVRS is not obvious. The flood pulse which drives the eco-hydrological functioning of the floodplain may continue to generate a large area of inundated land. However, the presence of a seasonal flood does not necessarily qualify the area as a functional wetland (Verhoeven and Setter, 2009). Consequently, there should be no complacency in decision-making just because flooding still occurs. It is possible for an area to still be frequently inundated but for its ecological character to have been significantly changed.

The review presented above demonstrates that there is currently an on-going and progressive negative change in ecological character of the KVRS. The evidence reviewed demonstrates the loss of ecological components (such as the native vegetation communities, the faunal populations or the loss of soil), changes in ecological processes (such as alterations in infiltration rates, changes in hydrology or degradation of water quality resulting from increases in sediment run-off and contamination from anthropogenic sources of pollutants) and resultant alterations in ecosystem services (including pressures on food production through grazing, changes to food resources such as fisheries and reduction in tourism and recreational values).

Further issues have also been highlighted through consultation with local communities during the RAM. For instance, according to members of the local community, the duration of the inundation of the valley is

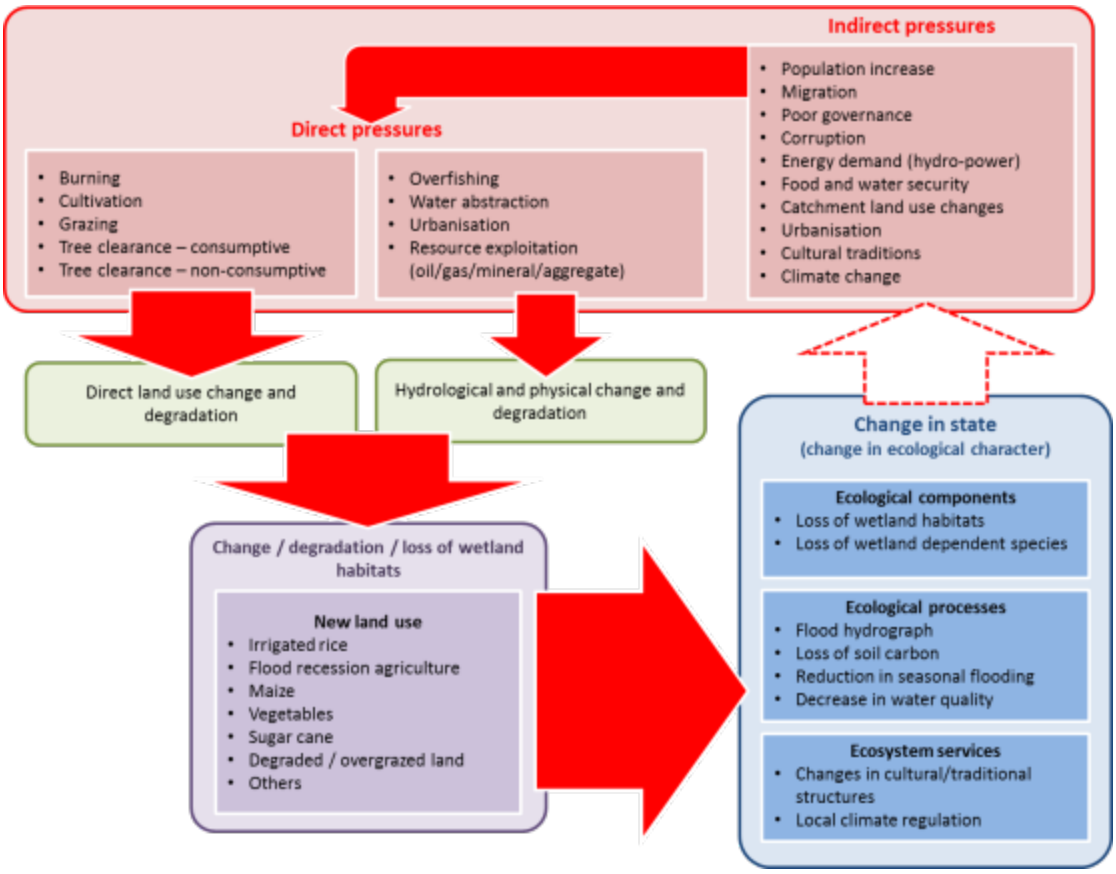
decreasing and thus reducing their cultivation areas. The fisherfolk had also detected direct impacts on water quality or other environmental values including changes in the number of fish species and reductions in fish size. The resident fisherfolk also stated that they are faced with illegal fishing by non-residents, even though illegal fishing *per se* may not be a negative influence on the overall fisheries resource (KILORWEMP, 2017).

There is substantive evidence, through peer-reviewed literature, published reports and consultation dialogues that the ecological character of the KVRS is undergoing human-induced negative change. In addition, further changes to the ecological character can be inferred using the best professional opinion of the RAM team members. It is part of the role of the RAM team to make otherwise undemonstrated linkages among human-induced alterations and the ecological character of the site. For instance, the increases in livestock numbers and the resultant overgrazing of certain areas will have contributed to soil compaction and loss of soil structure. This will result in changes to infiltration rates which can negatively impact the recharge of local groundwater supplies, which are vital for many domestic communities. Furthermore, the loss of the native vegetation cover through overgrazing will change evapotranspiration rates and consequently alter small-scale and local hydrological cycles. These changes will also impact on latent and sensible heat fluxes and the resulting cooling of air temperature. In turn this will raise local air temperatures and increase drought stress. In the absence of empirical data it is appropriate for expert opinion to highlight these linkages and the negative consequences of human interventions in order to both understand the risks to the Ramsar Site and also to inform future research and capacity building agendas.

Often the direct pressures which catalyse the incremental and sequential negative human-induced change in ecological character result from a broader set of indirect pressures. The indirect pressures include wider issues such as population growth and migration, cultural and traditional uses, rising energy demand, food and water security challenges, climate change, poor governance and weak regulation, corruption, ignorance and short-term decision-making.

Many of the indirect pressures arise from conflicting government policies and lack of joined-up thinking among officials and decision-makers. The need for improvements in this area has been highlighted in both the recommendations of the EFA and also within the IWRMD plan and calls for more effective coordination and participation have been made through the KILORWEMP work (KILORWEMP, 2016). The overall pressures, and the resultant changes in ecological character are summarised in Figure 7.

Figure 7. Current direct and indirect pressures and the implications for the ecological character of the Kilombero Valley Ramsar Site.



Article 3.2 of the Ramsar Convention provides that "each Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference. Information on such changes shall be passed without delay to the organisation or government responsible for the continuing bureau duties specified in Article 8 [i.e. the Ramsar Secretariat]". A number of decisions have been adopted and guidance and information texts developed relating to the implementation of Article 3.2. These include the following:

- Resolution VIII.8 (2002): Assessing and reporting the status and trends of wetlands, and the implementation of Article 3.2 of the Convention;
- Resolution IX.1 Annex A (2005): A conceptual framework for the wise use of wetlands and the maintenance of their ecological character;

- Resolution XI.1 Annex E (2005): The Ramsar integrated framework for wetland inventory, assessment and monitoring (IF-WIAM);
- Ramsar Handbook 15 (3rd edition, 2006): Addressing change in the ecological character of Ramsar Sites and other wetlands;
- Resolution IX.6: (2005): Guidance for addressing Ramsar Sites or parts of Sites which no longer meet the criteria for designation;
- Resolution X.15 (2008): Describing the ecological character of wetlands, and data needs and formats for core inventory: harmonized scientific and technical guidance;
- Resolution X.16 (2008): A framework for processes of detecting, reporting and responding to change in wetland ecological character;
- Document COP10 Doc 27 (2008): Background and rationale to the framework for processes of detecting, reporting and responding to change in wetland ecological character.

The importance of addressing change in wetland ecological character is related to the fact that under the Convention there is an objective of maintaining this character. The (revised) definition of "change in ecological character" is contained in paragraph 19 of Resolution IX.1 Annex A, and reads as follows: "For the purposes of implementation of Article 3.2, change in ecological character is the human-induced adverse alteration of any ecosystem component, process, and/or ecosystem benefit/service."

4. Current strategies and frameworks for the wise use of wetlands

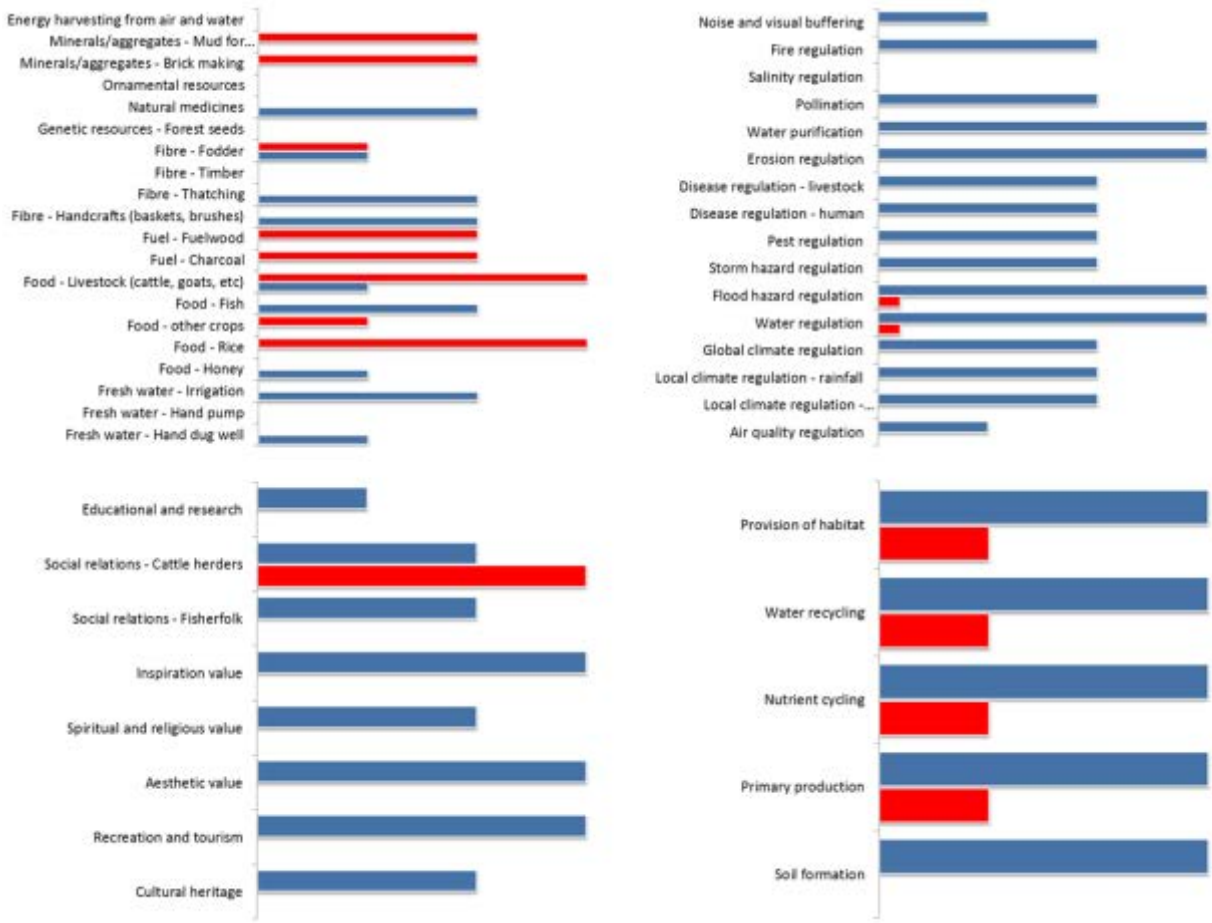
4.1. Background to wise use

Consideration of the benefits a wetland provides is essential to delivering wise use. Using a technique for the rapid assessment of wetland ecosystem services based on field observations and consultation with a variety of stakeholders (McInnes and Everard, 2017), the RAM team captured information on a range of benefits being provided by the Ramsar Site. These initial results were discussed during the consultation workshop at the end of the RAM, and suggest that the ecosystem services provided by the KVRS at the time of designation have been significantly reduced leading to loss of benefits at the local, district, regional and national level (Figure 8).

For instance, several of the provisioning services are in direct conflict. Consequently, the unsustainable burning of trees for fuel wood or charcoal provides a short-term benefit at the expense of the provision of thatching material or materials for handicrafts.

However, it is in the regulating services that the changes are most significant. The degradation of the wetland resulting from the loss of native vegetation, the compaction, erosion and loss of soils and the changes in the hydrological functioning of the floodplain, through modification of flood resident times, infiltration rates and evapotranspiration, are manifest by impacts on a range of regulating services including reduction in the ability of the wetlands to remove nutrients and other contaminants and hence purify the water, the ability of the wetlands to store and sequester carbon and thus aid global climate regulation and the changes to local hydrological and climatic conditions, such as loss of the local cooling effect of wetlands, resulting from land use changes.

Figure 8: Ecosystem services provided by relatively unimpacted (blue) and degraded (red) wetlands of the Kilombero Valley.

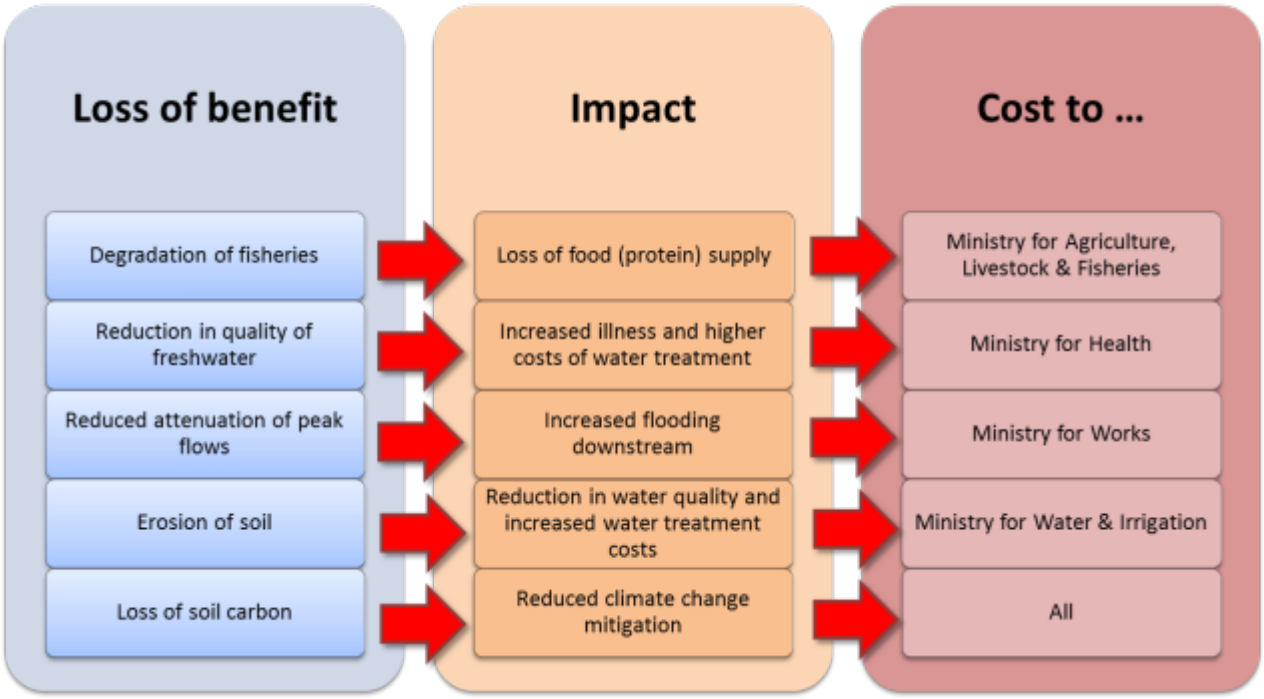


The changes to the wetlands are also compromising the cultural value of the area. Traditional and spiritual values which link the communities on the floodplain to those on the surrounding land are being degraded (as has been seen elsewhere within Tanzania (Duvail et al., 2006)) and, as ecological character of the wetland degrades, recreational activities,

especially hunting, are much reduced as a result of the associated loss of wildlife.

The reduction in all of these benefits translates into direct and indirect costs which must be borne across other levels of government and society in Tanzania. Whilst there are nuances to all of these relationships, the implications of some of these lost benefits are illustrated in Figure 9.

Figure 9: Some of the implications of the costs of inaction and failure to address the issues at Kilombero Valley.



4.2. Challenges to current strategies and frameworks

Strategic Frameworks

Several strategic frameworks are relevant to the management of the KV wetlands and water resources. These include:

- The Water Policy (2002) reflects the shift in approach towards comprehensiveness, subsidiarity and economics. The policy states that a holistic water (river) basin approach, integrating multi-sector and multi-objective planning and management, should be taken in order to ensure sustainability and protection of the resource. It advocates decentralised decision-making and a participatory planning approach; that the use of water should reflect its scarcity, as should its price, thus recognising water as an economic good; it further promotes cost sharing and other incentives for enhancing efficiency in the use of water. The policy

also emphasises the ecological aspects of water management and the need to ensure water allocation to maintain ecosystem health.

- Biodiversity and wildlife conservation are legislated by the Wildlife Act 2009, which was developed under the Wildlife Policy 2007. This framework is pertinent to the management of the core area of the KVRS, which is expected to be maintained as a GCA. A critical development of WCA 2009 was foreseeing that GCAs (exceeding 20 sites across the country) may need elevation to the better PA (GRs) protection category to ensure their conservation viability. With the elevation to a more protected status, GCAs lack a specific regulatory framework; MNRT is currently undertaking the development of GCA regulations.
- The National Land Policy 1997, Land Act, 1999 and the Village Land Act, 1999 were adopted by the Government. These Acts exhibit a special relevance to the KVRS through the effectiveness of village land use survey and planning in providing security of tenure; and as a means to harmonize and regulate land use, especially in areas of growing population and conflicting land demands.
- The RAM ToRs highlight the fact that wetland management historically in Tanzania has fallen within the biodiversity and wildlife conservation sector. The Sustainable Wetland Management Programme (2004-2011) was implemented jointly with MNRT and PMO-RALG and supported by DANIDA. The programme assisted stakeholders to strengthen the overall framework and management system in the country between 2004 and 2011. It produced a number of technical guidelines/tools, which are CBNRM based (i.e., sectorial, for wildlife, forestry, livestock, fisheries, irrigation). These guidelines have undergone testing including development of the needs at different levels but have yet to yield the desired results. It is worth noting that a large proportion of the guidelines are based on established CBNRM systems in the country for Wildlife Management Areas, Village Forest Reserves, Beach Management Units) (relevant to the management of resources in village land, not in state land). The guidelines do not deal with complex land use / catchment coordination at a scale above CBNRM units. This calls for a more holistic approach (IEMP) in bringing the guidelines together at landscape level. There was also an attempt at producing a wetland strategy and a wetland regulation. The wetland strategy was not passed by Cabinet and the draft regulation is pending awaiting the draft wetlands management regulation prepared by VPO – Environment Division, which is at its final stages. Discussions are still underway as to whether to have one regulation or develop different regulations to implement each sector ministry's legislation.

- Cirelli & Morgera (2010) state that the Environmental Management Act (EMA) 2004 provides a framework for inter-sector harmonization from an environmental management viewpoint. While wetland management was originally established in the country as part of wildlife management under MNRT, within the framework of the Wildlife Policy of 2007, more recently the VPO, among other prerogatives, has started taking a policy lead in the wetland domain. The new role of VPO under EMA 2004 is potentially in line with the need for providing an inter-sector coordination framework for complex wetland sites. However, institutional capacities to achieve that goal are still scarce. VPO has very limited outreach capacity. Such capacity is essential as EMA is a framework act which is to be implemented by all sector ministries. The weakness is especially evident at the local level, and mechanisms of coordination with sector agencies such as MNRT, which are still expected to lead wetland site management, are yet to be worked out. There is at best very little experience within GoT agencies in establishing, leading and supporting multi-stakeholder processes required by the growing management and governance complexity of sites like KVRS.
- The forest sector, under the Forest Act 2002 provides, *inter alia*, for the establishment of participatory forest management in state land (Joint Forest Management) and village land (Collaborative Forest Management in village forest reserves).
- Agriculture development plans, encompassing multiple initiatives, spearheaded under SAGCOT or GoT's Big Result Now programme. These plans include the development of several tens of thousands of hectares of irrigated paddy. USAID is supporting a feasibility study of four irrigation schemes in the Kilombero valley; this support includes the preparation of the EFA which provides a key input to clarify the feasibility of the agriculture plans and the trade-offs with other water resource demands. A large WB-financed SAGCOT Support project is in the pipeline to facilitate investments and capacity development. The EU supports the SAGCOT with a multi-sector programme: post-harvest infrastructure, roads, electrification and the environment (the last via their KILORWEMP co-funding). The review above has demonstrated that recommendations provided by the EFA need to be implemented in a manner that adopts a precautionary approach.
- The IWRMD plan for the Rufiji River Basin has been developed under the auspices of the under the Ministry of Water. The plan focussed on topical areas including IWRMD Plan; IWRMD Plan Implementation Strategy; Stakeholder Participation, Capacity Building, and Communication Plan; Basin Monitoring Plan; Sectoral Plans; and LGA Plans. The KVRS appears within the

analysis proposals covering the diagnosis of IWRM problems in the Rufiji River Basin, the water demand targets, the management recommendations and the strategies and strategic actions. Again, as with the EFA work, threats to the ecological character of the KVRS are identified and a precautionary approach is recommended prior to finalising water resource management decisions.

4.3. The Kilombero and Lower Rufiji Wetlands Ecosystem Management Project

MNRT is currently supported by the Belgian government with co-financial support from the European Union as part of the EU support programme to SAGCOT to implement the Kilombero and Lower Rufiji Wetlands Ecosystem Management Project (KILORWEMP). The project is executed in Rufiji DC in the Coast Region and Ulanga and Kilombero DC in Morogoro.

According to KILORWEMP (2014) the project started in December 2012 and has duration of five years; and its specific objective is "Strengthened capacities to implement the sustainable management policy and regulations to the Wetlands Ecosystem of the Kilombero Valley and Lower Rufiji, fostering sustainable livelihoods development and more effective natural resources governance within the decentralization framework." The project is composed of three components. The first component supports the development of Community Based Natural Resource Management (CBNRM) systems in village land in the three target Districts. This component aims at developing capacities to establish and manage Wildlife Management Areas (WMAs), Village Forest Reserves (VFRs), Beach Management Units (BMUs), and Village Land Use Plans (VLUPs). These local level environmental management and devolution systems are the constituents of decentralized natural resource management according to the country's policy framework. The second component deals with the development of business models and livelihoods from CBNRM.

The third component supports the development of sustainable wetland management capacity at regional (landscape) and national levels. Specifically, this component supports MNRT and other concerned authorities and relevant stakeholders in consolidating the Kilombero Game Controlled Area (KGCA); preparing a management plan for the KGCA; supporting the development of functions and capacities for the coordination of land use and conservation outside the boundaries of the KGCA and within the boundaries of the KVRS (Integrated Management Plan or IMP); supporting technical data collection and analysis required for the above tasks; supporting policy review towards strengthening the

relevant policy framework for the same goals; and supporting capacity development at multiple levels across the landscape.

The KILORWEMP project supports MNRT and other stakeholders through recommendations to develop a dual management system for biodiversity conservation and wetland management in the valley:

- A core GCA (about 3,000 sq km) will be managed as a protected area within the existing wildlife legislation. In limited areas around the GCA, a buffer zone is expected to be established. The GCA will be managed through a General Management Plan (GMP) under central government (TAWA).
- The area between the GCA and the Ramsar Site boundaries will mostly comprise village land and will be managed through the development of an Integrated Management Plan (IMP). A process and guidelines for land use harmonization and stakeholder coordination will be established through the IMP in order to provide guidance for conservation of biodiversity values and wetland functions in this land.

The project plan foresees three broad phases:

- Phase I will consist of completion of the boundary consolidation exercise of the GCA; and tangible assessments and diagnostic studies which will feed stakeholder consultations and regulation development by MNRT. These activities will also lead to the detailed definition of the scope of the GMP and IMP.
- Phase II will consist in the detailed preparation of the GMP and IMP based on the findings of phase I based chiefly on the analysis generated through phase I and further consultations.
- Phase III will consist in deploying concrete steps to operationalize the key provisions of the IMP and GMP.

4.4. Linking pressures to failures to deliver wise use

Wetlands in Tanzania are under significant pressure and have been subject to degradation for decades (Kamukala and Crafter, 1993). Important ecosystem and livelihood support functions are disappearing. There is usually a balance between long-term and short-term benefits, as with utilization of natural resources in general. Short-term use may provide a surge in income but such benefits are seldom sustainable. They almost inevitably only reach a few beneficiaries, and important or vital survival opportunities and strategies for the communities at large are often reduced or removed. Long-term sustainable planning and utilisation is more difficult but may give a larger and more continuous benefit over time to more beneficiaries, including the poor. In situations

of poverty and competition for resources, short-term benefits tend to dominate.

- Population centres are often situated near wetlands and water. Combined with general poverty and a focus of the people on day-to-day survival, implementation of the wise use principle is a great challenge. If overall planning is implemented in communities without supporting local planning and management tools, local communities will not be able to cope simultaneously with poverty and sustainable wetlands resource management. Because many wetlands do not belong to anyone in particular, there will often be a lack of responsibility towards sustainable use of the wetland resources (i.e. people will often not look after what is not their own). The linkages between the benefits from the wetland resources and the local communities living next to and being able to manage these resources is often too weak and needs to be enforced. Common management systems with defined user rights are generally positive for the sustainable management of resources. Open access to resources, with no defined responsibility, is however often detrimental to sustainability.

- The cross-sectoral nature of wetland management poses a continual challenge for proper management and planning. Essentially, wetlands are large interlinked water systems, which do not follow or obey administrative or political boundaries. However, management interventions upstream in one administrative area may have significant impacts on the integrity and function of a wetland downstream in another district or region or even in another country. The negative downstream effects of the diversion of water will often only be acknowledged much farther downstream and will often be the result of many minor cumulative diversions. Overall planning is currently almost limited to a compilation of lower levels' planning and integration of wetlands issues into the spatial and sectoral planning of districts and regions needs to be developed. A river basin management approach should help to address the problems in a more coordinated and comprehensive manner, but the planning and management involved is difficult to apply. The Ramsar Convention has adopted guidelines on integrating wetlands into River basin management, and some assessments have been conducted in this regard in Tanzania, but the implementation of the River basin approach still poses significant challenges.

- The lack of capacity to implement wetland management in terms of human and financial resources poses a great challenge. While at national level the budget allocations for wetland management have been gradually increased, the allocations for lower administrative levels remain insufficient. The regions currently coordinate district planning, and monitor the compliance of plans with sectoral legislation. The

capacity to produce regional planning and guide the districts in this process is, however, limited.

[redacted]Several stakeholders, such as village leaders and through the consultation workshop, identified the effects of livestock grazing within the KVSR including the impacts on the physical and biological components of the wetland. The direct effects of livestock overgrazing include: the consumption of plant biomass: trampling of plants, including below-ground parts and soil: nutrient inputs and bacterial contamination dung and urine, and; the introduction and dispersal of seeds and other propagules.

[redacted]Present day gender relations in rural Tanzania are characterised by women being more overburdened with work than men and facing more difficulties than men in gaining access to all kinds of resources, and in influencing decision-making. This gender imbalance is now widely recognised and addressed in various policies and guidelines. The Women Advancement and Gender Policy (2001) emphasises the importance of gender mainstreaming in all sectors. The Lands Act provides for equal access to land for women and men, recognises customary land rights for both genders, and includes provisions protecting women and other vulnerable groups from discrimination in relation to land rights, and yet violations of women's rights are still an everyday occurrence.

[redacted]Women's participation in committees and fora dealing with natural resource management at village level is increasingly included in policies and guidelines and is appreciated and practised in many areas. The Village Land Act (1999) and the adherent guidelines specifically stipulate the number of women there must be in different committees, the number of women that must be present for a meeting to attain its quorum and methods to involve women actively in the discussions. This will not in itself ensure women's influence in planning and activities but it does provide a good platform from which to do so.

[redacted]Tanzania clearly needs to pursue development opportunities, and mineral wealth may be a significant part of this. Nothing in the Ramsar Convention implies any stance one way or the other on the principle of this. Mineral exploration and exploitation can be entirely compatible with Ramsar obligations if pursued in ways which follow international good practice and which avoid unwise use of wetlands as defined by the Convention, and provided that applicable procedural steps are followed (such as those relating to Article 3.2, discussed below). That said, the vulnerabilities and risks to the country's natural wetland and water resources (its "wetland wealth") from inappropriate developments are high, and it is right for the Government to take a cautious and environmentally diligent approach to this.

Gas exploration activities have been occurring at Kilombero Valley Ramsar Site. The greatest potential is felt to lie within the valley within the Ramsar Site. Prospecting proposals have been made but to date no site has been put into active production. In the course of consultations during the RAM mission gas development was said by some consultees to be the greatest threat facing the area.

Increasing cases of concern such as these affecting Ramsar Sites in Africa, in particular, will be reviewed at various Ramsar meetings including the Wetlands and Extractive Industry Dialogue in Accra in March 2017, the African regional meeting in Dakar in early 2018, and at the 13 meeting of the Conference of Parties (COP13) in UEA in October 2018.

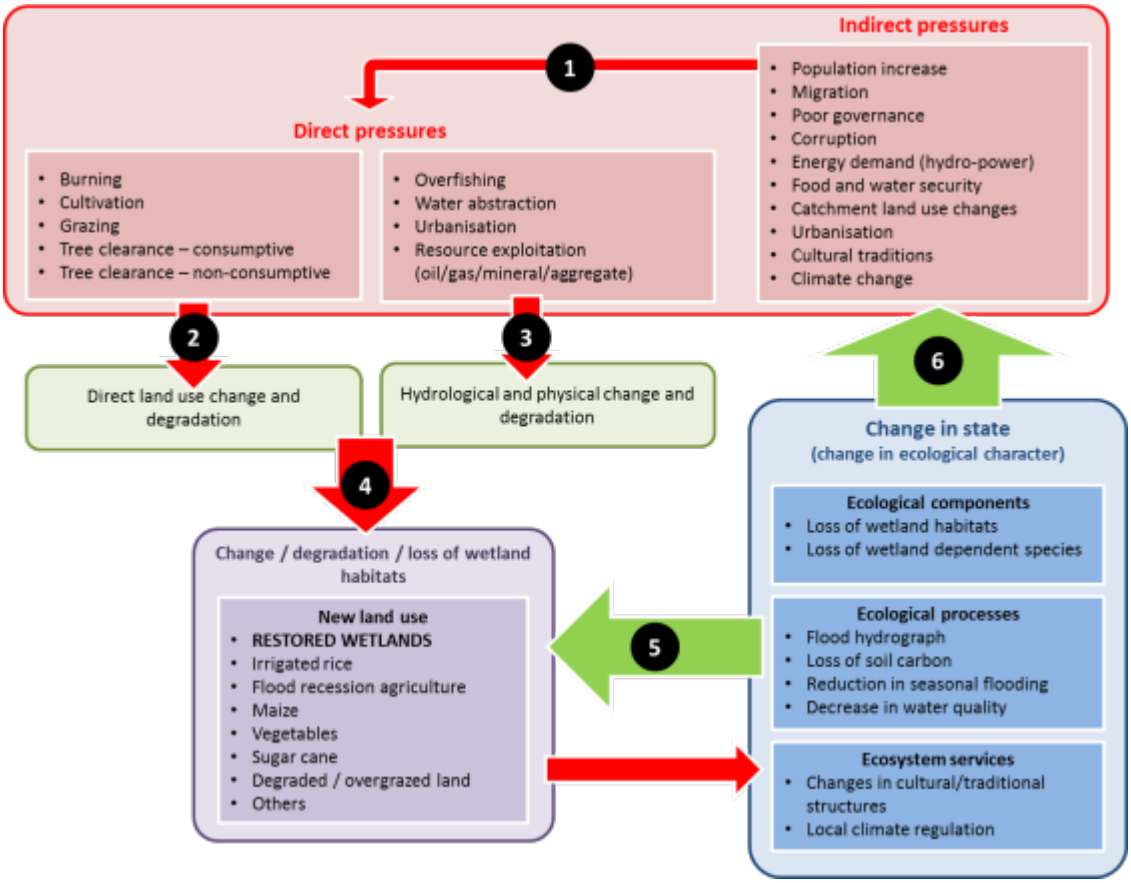
The Ramsar Convention has adopted guidance on 'Wetlands and Extractive Industries, (Ramsar Convention 2008a). This resolution urges Contracting Parties to 'to ensure that impacts on wetland ecosystems and their ecosystem services are avoided, remedied or mitigated as far as possible, and that any unavoidable impacts are sufficiently compensated for in accordance with any applicable national legislation. These procedures should allow sufficient time for collection of wetland inventory and baseline information to support effective Environmental Impact Assessment, permitting and oversight of extractive industries, especially with respect to enforcement of compliance with the conditions of authorizations and licences, and particularly to ensure that local and indigenous communities have appropriate opportunities to participate in decision-making.' Such an approach should be adopted in relation to any oil and gas exploration activities within the KVRS.

4.5. Discussion

Tanzania has a variety of robust laws and institutions which possess the potential to deliver wetland wise use both within the Kilombero Valley and across all wetlands. However, despite this, both indirect and direct pressures perpetuate negative human-induced change to the ecological character of the Ramsar Site.

The relationship among indirect and direct pressures and the ecological character have been discussed in section 2. It is possible to impose six points of intervention (black circles) onto the illustrative graphic and to consider how various actions can mitigate the pressures and ultimately rehabilitate the wetland (Figure 10).

Figure 10. Schematic describing the relationships among direct and indirect pressures on the KVRS and the resultant change in ecological character.



Intervention 1: Addressing link between direct and indirect pressures

Actions are required in order to reduce the impact of indirect pressures on the direct pressures. The paucity of joined-up thinking across different government ministries and departments needs to improve and the implementation and enforcement of sound regulations must be addressed. Actions require include:

- a review of the Ramsar-related policy framework pertinent to the KVRS and specifically the ways in which, and the extent to which, the Ramsar Convention's provisions have been, or should be, reflected in Tanzanian policies, plans relating to this case (such as the IWRMD plan), and in the decision-making processes being followed at site level (such as guidance on extractive industries, strategic environmental assessment, environmental flows and wetland site management planning); and
- a review of the implications of current key economic development initiatives in the KVRS for wetland management, such as irrigation or hydropower development, and how best to reconcile those processes with KVRS management measures through a precautionary approach.

Intervention 2: Addressing direct pressures (major land use change)

The direct pressures are resulting in unsustainable changes in land use and the continued and increasing rate of wetland loss. Interventions are required which immediately stem this loss and change of land use. Some actions are urgently required, such as improving patrolling and enforcement of laws and plans, such as village development plans. Other interventions require the sharing of technical experience on the best practices, structures, systems and processes for sustainable wetland management in order improve the efficiency of wetlands management in Tanzania. The shared technical experience should include but not be limited to:

- Integration of land-use planning, wetland management, water resource management and natural resource management;
- Private sector involvement;
- Raising awareness of the implications of short-term profits over ensuring long-term intergenerational equity sharing of the benefits that flow from the wetland;
- Improved skills among key stakeholders to provide support to sustainable wetland management;
- Framework established for inventory, assessment and monitoring of status, values and functions of Tanzania's wetland;
- Development of novel financing mechanisms, for instance around potential tourism options for wetlands.

Intervention 3: Addressing direct pressures (other pressures)

Some of the direct pressures lie beyond the boundary of the Ramsar Site but are manifest through changes to the ecological character of the site. For instance, catchment hydrological changes result in physical alterations to the flood hydrograph within the valley. Similarly, the quest to farm land and to improve economic status has brought migrants to the valley resulting in further pressure and degradation. Similarly, the control of water vectored diseases, such as malaria, paradoxically makes wetland areas more attractive for migrating peoples. Furthermore, uncontrolled or planned urban development is placing pressure on water resources and water quality beyond the physical boundary of the site but with implications for the ecological character of the Ramsar Site. Actions are required to consider how these wider direct pressures can be addressed through a more holistic and integrated approach, such as through an IMP, which resolves the issues before they are manifest in the Ramsar Site. The Ramsar Convention has adopted a range of guidance, on environmental flows, extractive industries, urban wetlands, etc. which provide advice and suggestions on how to shape possible interventions.

Intervention 4: Understanding limits of acceptable change

The Ramsar Convention accepts that human uses can be fundamental elements of the ecological character of Ramsar Sites. Unlike some

approaches to protected area management, the management of a Ramsar Site should be compatible with a range of human activities. However, an issue arises when these activities generate negative human-induced change which takes the site, or an element within it, beyond the limits of acceptable change. To address this, an improved understanding of the tolerances of the various components that comprise the ecological character of the site is required. Often the implementation of risked-based approaches can also be employed to ensure that risk is minimised, especially to sensitive ecological receptors.

- A more comprehensive understanding of the various elements of the ecological character of the KVRS is required (and should be aligned to the updating of the RIS). Understanding then needs to be developed in order to set thresholds and limits of acceptable change to the essential elements which comprise the ecological character.
- Risk-based approaches which identify the problem, describe the effects and their extent, defines the risk, establishes methods for managing and reducing risk and sets in place the appropriate monitoring regimes need to be developed (see Ramsar Convention, 1999).

Intervention 5: Restoration and rehabilitation

Currently the trajectory of the Ramsar Site is towards increasing wetland loss and degradation. Stemming this loss is the first challenge. The second challenge is to intervene to rehabilitate the remaining wetlands and to restore those that have been lost. To achieve this will require identification of opportunities and funding mechanisms. The Ramsar Convention has produced good guidance on wetland restoration (Ramsar Convention 2002). Often wetland rehabilitation and restoration can provide the opportunity not just to enhance an area for certain rare or protected species but also to deliver on wider policy objectives, such as sequestering carbon or improving water quality. The approach to restoration and rehabilitation should adopt the process advocated in Ramsar Convention (2002) which should seek to:

- Identify stakeholders;
- Establish priority goals, objectives and performance standards (these should be linked to protection, restoration or maintenance of the ecological character of the site);
- Identify and screen sites or areas;
- Assess compatibility of sites/areas with goals, objectives and standards;
- Develop conceptual plans; and
- Implement and monitor restoration activities.

Intervention 6: Link restoration and rehabilitation to other policy drivers

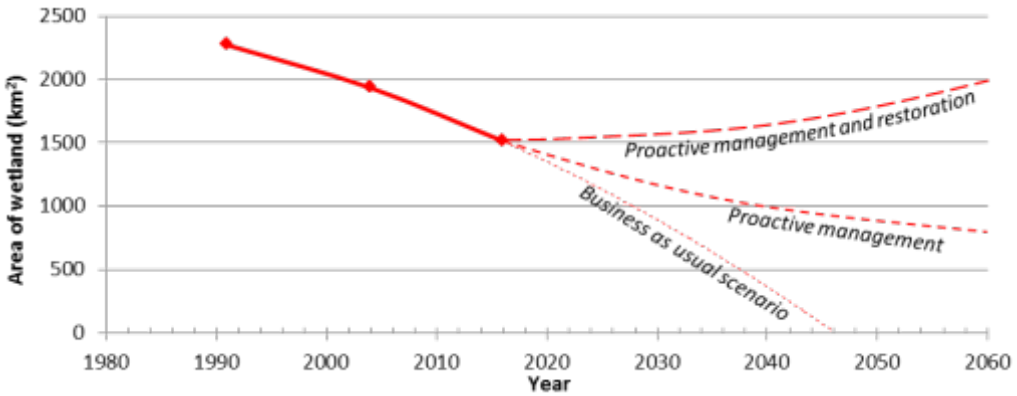
The loss and degradation of the wetlands in the Kilombero Valley is not just a nature conservation issue. As has been described previously, the continued trajectory of degradation will impact on a range of government ministries and the negative effects will be felt across multiple sectors of society. Therefore, interventions should seek to link Ramsar Site management to indirect pressures and particular through the need to address larger sustainability agendas including implementation of the Sustainable Development Goals (SDGs), as well as addressing disaster risk reduction (DRR), climate change and food and water security.

5. Conclusions and recommendations

5.1. Negative human-induced change

The KVRS is under intense pressure and subject to unsustainable levels of negative human-induced change on the ecological character of the site. Key ecological components, such as large mammal populations, are effectively gone from the site and changes in other components, such as soil carbon, are of serious concern. The change in the land use and the intensification of human activities such as cattle grazing, ploughing, irrigation and burning is severely compromising the multiple values that the site provides to human society. Urgent action is therefore required to stem this loss and degradation and to place the wetlands on a more sustainable trajectory (Figure 11). The priority should no longer be to establish proactive wetland management but should shift to also include the delivery of a programme of wetland rehabilitation and restoration. Proactive management alone will not reinstate the degraded and converted wetlands of the Kilombero Valley.

Figure 11. Actual rate of change in wetland/grassland extent and possible trajectories of different management options.



The downstream implications of the continued loss and degradation, in terms of water resources, power generation, the maintenance of viable

water resources for agricultural production, maintenance of the resilience of urban communities and ultimately to overall national GDP, are potentially significant. The costs associated with continued inaction greatly outweigh the costs of intervening.

[redacted] Incremental activities within the Ramsar Site, such as allowing another cattle herder to illegally graze their cattle or the clearing of another 20 ha to create an area for cultivation, act in consort to generate significant cumulative impacts. Such activities should not be considered as isolated incidents but part of an endemic failure to address issues at both the site scale but also within wider national contexts relating to *inter alia* agriculture, traditional cultural activities, population growth, climate change and energy and food security.

[redacted] Existing approaches to protected area management also seem limited in their ability to stem the loss and degradation of wetlands and are arguably incompatible with the Ramsar concept of wise use. The re-delineation of the boundary of the GCA is not considered to represent a sustainable solution which will deliver wise use of the wetland. It has been acknowledged that the management of the GCA has controlled hunting but has failed to deliver wider conservation benefits. Such unilateral management approaches are not compatible with the multilateral requirements of wise use. Therefore other, potentially novel, mechanisms need to be considered and developed.

5.2. Recommendations

[redacted] The RAM mission highlighted the fact that waters originating from the KVRS and the Rufiji Basin are truly the lifeblood for Tanzania including the Morogoro region and Dar es Salaam, flowing through both regions to provide water and nutrients for agriculture, as well as food, energy and livelihoods. The storage capacity of the floodplain allows water to be released slowly downstream, thus sustaining water resources throughout the year and reducing the risk of flooding.

[redacted] However, there is a lack of implementation of a planned integrated basin approach to the management of the river and wetlands to maintain the many services and benefits that the river and wetlands provide for people and the environment. This integration also extends to the proposals surrounding increase agricultural production through the SAGCOT initiative and through the District and village level land use planning. Currently, management is conducted by various stakeholders, both local and regional, with insufficient coordination between them. Often the linkages among different actors, sectors and policy drivers are weakly understood and consequently the unintended consequences of many actions result in unsustainable and ultimately detrimental outcomes.

Therefore, solutions are required to be put in place through a programme of measures that embrace the multiple cross-cutting issues, including, but not limited to, SAGCOT, IWRMD plan, DLUFPs, protected area management, that can stem the loss and degradation of the wetland, and ensure delivery of wise use. Where uncertainties exist, for instance with regards to data or understanding, adopt a precautionary principle.

Recommendation 1: Address cross-cutting issues
Ensure that wetlands are considered appropriately within and across all major development and natural resource management related initiatives through the establishment of appropriate champions, stakeholders or representation and where necessary adopt a precautionary approach.

All the Ramsar Information Sheets (RIS) for all of the Tanzanian Ramsar Sites require updating. Ensure that there is appropriate information provided to adequately describe the ecological character of the KVRS. This is particularly important and urgent for the Kilombero Valley Ramsar Site.

Recommendation 2: Update the RIS for the KVRS
Describe fully the current ecological character of the site and re-examine the criteria for which the KVRS qualifies for inclusion on the list of wetlands of international importance

Develop, through a participatory approach a management plan for the Ramsar Site. This must be wider-reaching than the GCA and should incorporate appropriate zoning across the entire Ramsar Site. Currently the focus of approach advocated through the KILORWEMP project is to consolidate the KGCA and develop a wider IMP for the Ramsar Site. This emphasis needs readdressing. The overarching plan (under whatever name is deemed appropriate, e.g. Ramsar Management Plan or Integrated Management Plan) should be the primary plan and the KGCA general management plan should be nested in the larger plan for the Ramsar Site.

Any management plan that is developed for the KVRS should also discuss and provide recommendations on value of ecosystem services (as key elements of the ecological character of the site); and activities including the removal of illegal structures, activities and encroachments which otherwise would obstruct the flow of services and impact on the capacity of the site to provide benefits to human society.

Recommendation 3: Develop a management plan for the KVRS
Use a participatory approach to develop a robust management plan for the Ramsar Site that provides the overarching framework for natural resource management within the Kilombero Valley.

Based on the follow-up (or lack there-of) to the recommendations made following the earlier RAM to Lake Natron in 2008, the RAM Team recommends that responsibility for wetland management (all wetland areas not just Ramsar sites) in Tanzania be vested in a new unit of the Ministry of Natural Resources and Tourism. The proposed Wetlands Division should be at the same level as the Wildlife Division thus allowing it to become the voice for "wise use" of Tanzania's wetlands that is missing in the current arrangement where overlapping and contradictory mandates lead to no one agency being responsible for one of Tanzania's most valuable natural resources.

Recommendation 4: Create a 'Wetlands Division' in MNRT
Create a new division within MNRT to take the lead responsibility for wetland conservation and wise use in Tanzania.

In addition to a national Wetlands Division, a broad-based coordinating authority or management committee should be established for the sustainable management of the KVRS and its resources, e.g. water, fisheries, biodiversity, as well as for pollution control and flood management. Such site management authorities and committees have been successfully established elsewhere and assist greatly in delivering sound management outcomes (for instance Lutembe Bay Ramsar Site in Uganda, through the assistance of the Ramsar Centre for East Africa (RAMCEA) constituted and trained a site management committee comprising community representatives from villages and stakeholders from the private sector, fishermen and the beach management units).

The coordinating body should be tasked with drafting and regularly updating inputs into the IWRMP plan, SAGCOT initiative and other strategic programmes and to contribute to the understanding of up-stream land-uses with the needs of down-stream users, which can also maintain the social, economic and environmental benefits that the river provides through maintaining environmental flows.

It is essential that the coordinating authority has cross-sectoral representation from government (including across different ministries and from local to national levels) and from civil society.

Recommendation 5: Establish a management authority for KVRS
Establish, constitute and enable the operation of a dedicated management authority or committee drawn from multiple sectors and stakeholders to facilitate the integrated management of the Ramsar Site

To respond to the water resources challenges, the Ministry of Water and Irrigation (MoWI) through Rufiji Basin Water Board (RBWB) in collaboration with Development Partners (DPs) has prepared an Integrated Water Resource Management and Development (IWRMD)

plan for the Rufiji River Basin to address the water resources challenges and natural resources of the Kilombero sub-basin. The preparation of an IWRMD plan is a requirement under the water law of Tanzania (i.e., the Water Resources Management Act No. 11 of 2009 and NAWAPO of 2002). A major notification of the Plan is that the Kilombero sub-basin can indeed provide its full societal and environmental promise to its communities and Tanzania at large, but for this to occur, there must be a systemic change in the way water and environmental resources are used. However this can happen if and only if the management of water resources is implemented in integrated way by both levels of government institutions and by the stakeholders themselves.

In order to deliver on the plan, a hydrological model should be developed for the whole of the Kilombero sub-basin. Both the IWRMD plan and the EFA work do not provide sufficient detail to fully understand the eco-hydrological functioning of the KVRS and how the various water resource-related developments will impact the ecological character of the site. Such a modelling approach should be able to assess the availability of surface and groundwater in order to provide the Rufiji Basin Water Board with solid recommendations for the proposed development projects (hydropower, irrigation, water supply) of water resources. Any such model for the Kilombero sub-basin should be developed based on key tradeoffs existing among the sectors with large water use requirements: irrigation, hydropower, and wetland ecosystem services. The model should address various trade-off options for managing the water resources in the sub-basin. The proposed model should provide greater understanding of the following:

- the relationships between natural inflows to the Kilombero sub-basin, wetland size and outflow;
- changes that might occur to inflows and outflows due to a reduction in rainfall, or an increase in evaporation;
- changes that would occur to inflows and outflows due to a change in land use in the high catchment; and
- changes expected under different climate change scenarios.

The proposed model should be developed based on, but not limited to, the following scenarios:

- How will population growth, economic development, and energy demand changes in the basin affect the availability of water for various economic sectors?
- What are the benefits and tradeoffs between water for agriculture, water for hydropower, water for ecosystems, and water for household use?
- What if more efficient irrigations techniques will be implemented?
- What if the mix of agricultural crops changes?

- What if groundwater is more fully exploited?
- How will unrestricted cultivation of wetlands and riverine banks affect the quality of water downstream?
- What if wetland water conservation is introduced as a management policy in each of the rivers in the Kilombero basin?
- What are the benefits from joint water management in the basin?

[redacted]Under the SAGCOT programme there are a lot of planned irrigation projects in the Kilombero sub-basin. Preliminary assessment done under the IWRMD plan shows that water use under irrigation for 2015 and 2035 will cause depletion of dry season flows below Environmental Flow Requirements (EFRs) in the Kilombero River. The study went further to propose the approach to meet the sub-basin water use requirement for 2025 and 2035 targets. The proposed approaches are; (i) transferring water from the wet to the dry season through the use of proposed hydropower dam storage (i.e., Ruhudji and Mpanga) and (ii) adopting a conjunctive, surface-ground water management strategy. Because the Kilombero Valley also includes considerable wildlife and biodiversity resources and potential for fisheries and aquaculture development, the proposed hydrological model should assess the amount of ground water resources available in the sub-basin, the impacts of proposed dams in the streamflow, the impacts of irrigation development on water resources, and how much water should be left in the stream for environmental purposes.

Recommendation 6: Develop a hydrological model for the Kilombero sub-basin
Develop a hydrological model, which goes beyond the current approaches applied in the IWRMD plan and the EFAs, that can fully simulate the eco-hydrological functioning of the KVRS and the wider Kilombero Valley so that genuinely informed decision-making can be undertaken with regards to water resource management and socio-economic development options.

[redacted]There are plans to construct irrigation dams and water control structures that will reduce the amount of water reaching the wetlands in the valley. This will have a range of impacts on the livelihood of the people and the ecological character of the site. In managing the Rufiji Basin, there is a need to ensure the water flows in the river is such that downstream users can continue to benefit from the services that the river provides. Therefore specific actions are proposed to address the challenges associated with irrigation, including:

- All irrigation schemes (proposed and constructed) are subjected to Environmental Impact Assessment (EIA) studies or certification as required by law (Environment Management Act 2004 under Section 81).

- Under Section 43 of the Water Resources Management Act 2009, all water abstractions require a Water Use Permit issued by the Basin Water Board. The Act sets priorities for water allocation in line with the National Water Policy. The first priority is domestic use; then an environmental reserve, followed by economic activities. The existing EFA work has focussed on five sites and four irrigation schemes and acknowledges the limitations of this approach, especially with regards to understanding the wider floodplain eco-hydrological relationships. Consequently, there is an urgent need to undertake Environmental Flow Assessment (EFA) for all major rivers in Kilombero sub-basin and also a need to build capacity of the BWB staff to undertake the study themselves rather than relying on expensive external experts.
- All irrigation schemes should be installed with flow measuring equipment so as to monitor the amount of water issued in the permit for compliance purposes.
- All irrigation canals must be lined to reduce the amount of water loss and increase irrigation efficiencies.

Recommendation 7: Ensure the sustainability of all irrigation schemes
Ensure that all irrigation schemes are subject to appropriate environmental impact assessments, are modelled appropriately to understand the water resource management and environmental flow implications and are designed, constructed and operated in line with best environmental standards.

[redacted]In order to further develop and refine the hydrological understanding there needs to be improvement in the water resources monitoring network across the Kilombero catchment and in the availability and reliability of data. Proposals have been made in the EFA work and improvements could include the construction and rehabilitation of key hydrometric stations, the construction and installation of weather stations, the use of telemetric systems, drilling of ground water monitoring wells and installation of monitoring equipment and undertaking targeted water quality and river flow measurements as per basin monitoring programme.

Recommendation 8: Improve hydrological data resources
Enhance and develop the existing hydrological monitoring network to ensure that robust and reliable data are available for decision-making.

[redacted]The level of cattle grazing in the Ramsar Site is contributing to the negative change in the ecological character of the wetland. However, resolution of the cattle grazing issue is not only a Kilombero issue. There needs to be robust and coherent national masterplan that considers and addresses the issue on a country-wide basis. Simply removing cattle from

Kilombero is not a solution and also has been implicated in human rights abuses. There needs to be a strategy for the Ramsar Site, nested within the national masterplan, which ensures that the level of grazing is sustainable and that the livestock numbers are appropriately policed and regulated. Any such plan must also be translated through the planning system to strictly applied and enforced DLUFPs and village plans to ensure delivery on the ground.

[redacted] As part of the larger strategy and masterplan, seek to manage both infrastructure and veterinary services in areas for cattle outside of the KVRS and where necessary evacuate the livestock from the site.

[redacted] Investigate approaches which seek to devalue cattle equitably so that the relative number is reduced but the relative value remains the same. For instance, a policy which implemented a 10% reduction in all cattle herds would reduce the total number in an equitable way whilst retaining the relative value. Similar approaches have been tried in Kenya in order to manage overgrazing and cattle numbers.

Recommendation 9: Adopt a sustainable approach to livestock management
Develop and implement fully a robust, integrated and coherent national livestock plan and strategy which will deliver a long-term solution to livestock management not only within the KVRS but across Tanzania.

[redacted] The involvement and participation of stakeholders is essential in order to achieve the wise use of wetlands. Stakeholder participation should be enhanced through:

- Promoting and encouraging livelihood projects that reduce pollution and enhance conservation of water sources.
- Designing and supporting communities to implement alternative income generating activities linked to village savings and loans associations.
- Introducing and promoting alternative sources of renewable energy.
- Developing and implementing water sources protection and conservation plans.
- Promoting public private partnership in water sources protection and conservation.
- Working with existing stakeholder groups, such as village committees, WUAs, DFTs and CBNRM groups.

[redacted] Awareness of both the benefits provided by the wetland and the impacts of certain activities needs to be increased. For instance, this could be achieved through:

- Introducing competitive schemes (school clubs) and incentives for exemplary water sources protection and conservation.
- Engaging politicians to spearhead an agenda for protection and conservation of water sources at different levels and political platforms.
- Involving WUAs in the management of the catchment.
- Explaining the impact of pursuing short-term financial gain, through corruption and accepting illegal payments, and the loss of intergenerational equity of resource allocation and benefit.

Recommendation 10: Raise awareness of the importance of wetlands
Work with a range of stakeholders and through a variety of media to develop, implement and monitor a robust awareness raising programme that explains, describes and promotes the importance of wetlands for human wellbeing.

Capacity needs to be strengthened and built across a range of sectors but crucially this is required in the water resources management institutions at basin and community level. In order to achieve this the following are proposed:

- Establishing new WUAs and strengthening of existing ones in the Kilombero sub-basin through the provision of working tools such as offices, equipment, training and transportation (motorcycles or bicycles).
- Establishing Sub-catchment and Catchment committees.
- Establishing, training and equipping communities for water sources protection.
- Building the capacity of Basin Water Boards on enforcement of the legislation.
- Raising public awareness on relevant legislations.
- Building capacity of Basin Water Boards on the Management Water Quality and Pollution Control. Strengthen water quality and quantity monitoring networks.
- Promote sustainable farming practices (e.g. use of biodegradable fertilizers, herbicides and pesticides).
- Encourage and support construction of livestock watering facilities on grazing fields.

Recommendation 11: Build and strengthen capacity in key institutions and organizations
Improve knowledge, understanding and resourcing within key organizations and institutions across the KVRS and the wider basin in order to facilitate improved water and natural resource management.

Many of the issues which are affecting the Ramsar Site need to be addressed through actions to be implemented across the wider catchment. These include:

- Identification and assessment of degraded land and water sources hotspots, i.e. areas where there are significant impacts on water resources, for instance through abstraction activities or pollution.
- Supporting the implementation of sustainable agricultural practices for farmers across the catchment, including best practice in soil management, irrigation and fertilizer application.
- Restoration of degraded areas of land.
- Preparation, implementation and enforcement of the outstanding village land use plans and appropriate support for their subsequent implementation.
- Working with traditional knowledge and land management practices.
- Implementation of diversified income generating activities which reduce both direct and indirect pressures on the Ramsar Site.

Recommendation 12: Promote sustainable land management in the Kilombero River catchment
Develop an integrated land management approach across the Kilombero River catchment which seeks to reduce downstream impacts on the ecological character of the KVRS.

The implementation of all the previous recommendations will contribute to the proactive management of the KVRS and will assist in stemming the ongoing loss and degradation of the site. However, significant areas of the KVRS are degraded and require restoration and rehabilitation in order to replace the lost elements of the ecological character of the site.

Recommendation 13: Develop a prioritised restoration plan for KVRS
Develop a prioritised restoration and rehabilitation plan for the degraded areas of the KVRS in order to restore the ecological character of the site.

To follow-up from the RAM, it is strongly recommended that the various recommendations described are translated into an action plan to be implemented under the guidance of the Administrative Authority.

Recommendation 14: Establish a RAM implementation action plan
Develop an implementation plan that will allow progress on the recommendations to be assessed and reported on through the triennial Ramsar National Reporting cycle.

The individual recommendations are set out in Table 4 to illustrate how the individual recommendations of the RAM Team build on observations and observed challenges to address the RAM ToRs.

Table 4. Recommendations mapped against the ToRs , observations and challenges.

Terms of reference	Observations and challenges	Recommendations
To review and provide advice on the policy framework pertinent to the KVRS and specifically the ways in which, and the extent to which, the Ramsar Convention's provisions have been, or should be, reflected in Tanzanian policies, plans relating to this case, and in the decision-making processes being followed at site level.	• Good policies and legal frameworks in place, such as the Water Policy (2002), Village Land Act (1999) and the Wildlife Act (2009).	• 1
	• The Environmental Management Act (2004) in particular provides a good framework for inter-sector harmonization.	• 1
	• Well-established governmental institutions in individual ministries.	• 1 • 2
	• Well-established levels of governance at local, district, regional and national levels.	• 1 • 2
	• Well-established categories of protected areas including game reserves, wildlife management areas, national parks, game controlled areas and beach management units.	• 1 • 3
	• Despite good institutional and policy frameworks there is poor cross-sectoral integration across government departments regarding wetland wise use. This is partly as a result of limited institutional capacity and experience.	• 1 • 4 • 5 • 11
	• This has resulted in overlapping and conflicting management responsibilities among the various authorities and regulators.	• 1 • 4 • 5 • 11
	• The monitoring, regulation and enforcement of policies, such as the implementation of village plans arising from the National Land Use Planning Commission Act (2007), is poor, under-resourced and open to corruption.	• 1 • 11
	• There is also poor integration and coordination across different level of governance from local to national resulting in a blame culture where the cause of inaction or failure is passed either up or down the level of governance.	• 4 • 5 • 11
	• Despite the presence of good documentation, developed through the Sustainable Wetlands Management programme and community-based resource management approaches, there is limited uptake or implementation of Ramsar related guidance and resolutions and minimal evidence for such recommendations being embedded in decision-making at a strategic or site level.	• 4 • 5 • 10 • 11
	• At the Ramsar Site level there is no single coordinating body that is effectively integrating the various policy frameworks and ensuring appropriate decision-making and delivery of wise use on the ground.	• 5
To review and provide advice on the implications of current key economic development initiatives in the KVRS for wetland	• Currently there is poor recognition or understanding of the ecological character of the Ramsar Site. Therefore, provisions for assessing change in ecological character are inherently weak. The primary focus of management activities appears to be on perpetuation and	• 2 • 6 • 10

management, namely irrigation development and the development of a IWRMD Plan for Rufiji basin; and how best to reconcile those processes with KVRS management measures. Assess the actions to put in place to prevent potential impact on the Ecological Character of the Site	realignment of a GCA, rather than ensuring the overall ecological character of the Ramsar Site is protected.	
	• Consequently, the poor appreciation of the ecosystem components and process and services which comprise the ecological character of the site limits the effectiveness of any measures implemented in order to prevent impacts.	• 2 • 10
	• Numerous development initiatives, both legal and illegal, are compromising the ecological character of the Ramsar and resulting in a rapid and increasing rate of wetland degradation and loss.	• 1 • 7 • 9
	• The preparation of the Integrated Water Resource Management and Development (IWRMD) Plan is a positive approach to contributing to the wise use of wetlands. However, to ensure that the ecological character of the Ramsar Site is maintained there needs to be strong integration across government institutions, involvement and participation of stakeholders and sound knowledge, potentially achieved through monitoring and hydrological modelling, to deliver sustainable outcomes.	• 1 • 6 • 8
	• Failure to consider all the elements of the ecological character of the Ramsar Site in assessing the impact of irrigation schemes, including the strategic, large schemes being considered through USAID funding and other such as the scheme associated with Kibasira Prison, and particularly the limited emphasis on economic return of irrigated agriculture in the environmental impact assessment process will perpetuate wetland degradation and fail to deliver wise use.	• 6 • 7 • 8
	• The lack of a strategic approach with appropriate enforcement mechanisms to the expansion of both agricultural cultivation and cattle grazing, and especially where this involves burning, ploughing and degradation of intact areas of wetland, is a clear indication that short-term economic return is being prioritised at the expense of future intergenerational equity sharing and protection with regard to wetland natural capital.	• 1 • 9 • 12
	• The overall assessment of the current, and the planned, economic development is that the true value of the wetland is not being reflected in decision-making and therefore any cost-benefit analysis is strongly skewed towards short-term monetised benefits with an explicit market value rather than an appraisal of the multiplicity of values that the Ramsar Site possesses.	• 1 • 2 • 10 • 12
To share technical experience on the best practices; structures, systems and processes of sustainable wetlands management in the world that would improve the efficiency of wetlands management in Tanzania.	• A considerable amount of technical best practice has been adopted by the Ramsar Convention in order to address *inter alia* the management of urban and peri-urban wetlands, wetlands and extractive industries, rice production and wider agricultural interactions, environmental flow allocation, water resource management, wetland restoration and participatory approaches to stakeholder engagement. Currently there is limited evidence that this guidance has been utilised in decision-making.	• 3 • 4 • 10 • 11
	• Globally there are multiple examples of best practice in the delivery of wetland wise use. Some examples of best practice were presented by members of the RAM Team at the Workshop.	• 10
	• The establishment of a cross-sectoral wetland management authority at the East Kolkata Wetlands, India and a management committee at Lutembe Bay Ramsar Site, Uganda, demonstrate a best practice approach to overcoming sectoral conflicts and	• 5

	managing potential trade-offs.	
	• The zonation of different management zones implemented at the Mai Po and Deep Bay Ramsar Site in Hong Kong could act as model for future land use zonation within the Kilombero Valley.	• 3 • 13
	• The Tana Delta Ramsar Site in Kenya has managed conflicts over land use and impacts on vital wetland livelihoods through the development of a land use masterplan that was drawn up in a participatory and integrated approach to ensure the consequences of negative trade offs were addressed.	• 1 • 3
	• In Cameroon, the Waza-Lagone floodplain Ramsar Site has been threatened by upstream dams and the demand for irrigation water for rice cultivation. Through the a range of alternative water management options, which actively sought to maintain the ecological character of the site and support livelihoods, positive outcomes have been achieved.	• 1 • 6 • 7 • 11
	• The GoT needs to consider the implications of best practice management and evolve context-specific solutions which will improve management efficiency across Kilombero Valley.	• 1 • 11 • 12
To provide advice on the possible ways to support sustainable wetlands management programme in Tanzania both technically and financially.	• The GoT has produced some excellent technical publications and associated advice on wetland management. However, the utility of these publications seems limited. Furthermore, numerous technical publications are freely available on the internet which address wetland management challenges.	• 4 • 10 • 11
	• Therefore, the challenge is not one of a shortage of technical information rather it is the translation of technical knowledge into action on the ground.	• 10 • 11
	• The wetlands in Kilombero Valley are all valuable. Understanding the multiple values of the wetlands is key to identifying novel or innovative financing mechanisms that can be implemented.	• 2 • 10
	• Financing mechanisms could consider payments for ecosystem services, polluter pays principles, development of carbon funds or establishing conservation stewardship programmes that provide tangible rewards for communities to local communities that protect natural resources.	• 1 • 3 • 10 • 11 • 12
	• Consider establishing community-owned ecosystem banks where funds received reside in the hands of all the community rather than in an elected minority.	• 1 • 3 • 5

6. Acknowledgements

This Mission was made possible by a financial support from the Belgian Development Cooperation (Belgian-Tanzania Study and Consultancy Fund) and WWF International. Thanks to Giuseppe Daconto and Pellage Kauzeni from KILORWEMP Project, and Denis Landenbergue from WWF International, Freshwater Programme. We are grateful to AWF for its participation to the RAM mission.

The RAM Team highly appreciated the participation of a representative from Vice President's Office during the mission. Particular thanks are also due to MRNT and KILORWEMP Project Staff, for swift and comprehensive organisation of all logistical and protocol matters both before and during the Mission, as well as the provision of a large amount of supporting information. The Staff also gave very valuable local assistance.

The wide range of participants listed in Annex 5 to this report, from central government, local government, residents, resources persons from universities, fishermen and experts from national projects, is testament to the intensity of public engagement in this case and committed interest in the Mission's purpose. The in-depth inputs received, sometimes including substantial written submissions and source material in addition to presentations and meetings during the visit, hugely enriched the team's perspectives on the issues at stake. We are profoundly grateful to all concerned.

The RAM team members also wish to acknowledge the supremely professional, measured and knowledgeable way in which all interactions during the Mission were conducted, regardless of viewpoint. The constructive spirit of Ramsar's RAM process could not have been better exemplified; and this too is much appreciated.

7. Bibliography

Balama, C., Augustino, S., Mwaiteleke, D., Lusambo, L. P., & Makonda, F. (2016). Economic Valuation of Nontimber Forest Products under the Changing Climate in Kilombero District, Tanzania. *International Journal of Forestry Research*, 2016. http://dx.doi.org/10.1155/2016/7893143

Birch-Thomsen, T., Elberling, B., Fog, B., & Magid, J. (2007). Temporal and spatial trends in soil organic carbon stocks following maize cultivation in semi-arid Tanzania, East Africa. *Nutrient Cycling in Agroecosystems,* 79(3), 291-302.

Bonnington, C., Weaver, D., & Fanning, E. (2007). Livestock and large wild mammals in the Kilombero Valley, in southern Tanzania. *African Journal of Ecology*, *45*(4), 658-663.

Bonnington, C., Grainger, M., Dangerfield, S., & Fanning, E. (2010). The influence of electric fences on large mammal movements in the Kilombero Valley, Tanzania. *African Journal of Ecology*, *48*(1), 280-284.

Castellano, M. J., & Valone, T. J. (2007). Livestock, soil compaction and water infiltration rate: evaluating a potential desertification recovery mechanism. *Journal of Arid Environments*, *71*(1), 97-108.

Cirelli, M.T. & Morgera, E. (2010) Wildlife Law in the Southern African Development Community. *FAO Legal Paper Online* #84. FAO, Rome, Italy. 104pp.

Duvail, S., Hamerlynck, O., Nandi, R. X., Mwambeso, P., & Elibariki, R. (2006). Participatory mapping for local management of natural resources in villages of the Rufiji District (Tanzania). *The Electronic Journal of Information Systems in Developing Countries*, *25*.

ERM (2012) *Southern Agricultural Growth Corridor of Tanzania (SAGCOT): Strategic Regional Environmental and Social Assessment (SRESA).* Interim Report to the Government of Tanzania. July 2012. 144pp.

Everard, M. & McInnes, R.J. (2013) Systemic solutions for water and environmental management. *Sci. Tot. Env.* 461 462, 170-179.

Hamisi, H. I., Tumbo, M., Kalumanga, E., & Yanda, P. (2012). Crisis in the wetlands: combined stresses in a changing climate–experience from Tanzania. *Climate and Development*, *4*(1), 5-15.

Haule, K. S., Johnsen, F. H., & Maganga, S. L. S. (2002). Striving for sustainable wildlife management: the case of Kilombero Game Controlled Area, Tanzania. *Journal of Environmental Management, 66*(1), 31-42.

IWGIA (2016). *Tanzanian Pastoralists Threatened: Evictions, Human Rights Violations and Loss of Livelihoods*. IWGIA Report 23. IWGIA with PINGO's Forum, PAICODEO and UCRT: Eks-Skolens Trykkeri, Copenhagen, Denmark. 91pp.

Jansen, A., & Healey, M. (2003). Frog communities and wetland condition: relationships with grazing by domestic livestock along an Australian floodplain river. *Biological Conservation*, *109*(2), 207-219.

Jenkins, R. K. B., Corti, G. R., Fanning, E., & Roettcher, K. (2002). Management implications of antelope habitat use in the Kilombero Valley, Tanzania. *Oryx*, *36*(02), 161-169.

Jones T., Rovero F. & Msirikale J. (2007) Vanishing Corridors: A Last Chance to Preserve Ecological Connectivity between the Udzungwa and Selous-Mikumi Ecosystems of Southern Tanzania. Final Report to Conservation International (URL: http://www.udzungwacentre.org/documents/Reports/vanishing_corridors_jones2007.pdf)

Jones, T., Bamford, A. J., Ferrol-Schulte, D., Hieronimo, P., McWilliam, N., & Rovero, F. (2012). Vanishing wildlife corridors and options for restoration: a case study from Tanzania. *Tropical Conservation Science*, *5*(4), 463-474.

Kamukala, G. L. (1993). An overview and scope of Tanzanian wetlands. *In* Kamukala, G. L., & Crafter, S. A. (1993). *Wetlands of Tanzania: Proceedings of a Seminar on the Wetlands of Tanzania, Morogoro, Tanzania, 27-29 November, 1991* (Vol. 10). IUCN: Gland, Switzerland.

Kamukala, G. L., & Crafter, S. A. (1993). Wetlands of Tanzania: Proceedings of a Seminar on the Wetlands of Tanzania, Morogoro, Tanzania, 27-29 November, 1991 (Vol. 10). IUCN.

Kangalawe, R. Y., & Liwenga, E. T. (2005). Livelihoods in the wetlands of Kilombero Valley in Tanzania: Opportunities and challenges to integrated water resource management. *Physics and Chemistry of the Earth, Parts A/B/C*, *30*(11), 968-975.

Kangalawe, R., Mwakalila, S., & Masolwa, P. (2011). Climate change impacts, local knowledge and coping strategies in the Great Ruaha River Catchment Area, Tanzania. *Natural Resources*, *2*(04), 212.

Kansiime, F., & Jones, M. B. (2014). Reviewing the carbon cycle dynamics and carbon sequestration potential of Cyperus papyrus L. wetlands in tropical Africa. Wetlands Ecology and Management, 22(2), 143-155.

Kashaigili, J. J., McCartney, M., Mahoo, H. F., Lankford, B. A., Mbilinyi, B. P., Yawson, D. K., & Tumbo, S. D. (2006). *Use of a hydrological model for environmental management of the Usangu Wetlands, Tanzania* (Vol. 104). IWMI.

Kashaigili, J. J., McCartney, M., & Mahoo, H. F. (2007). Estimation of environmental flows in the Great Ruaha River catchment, Tanzania. *Physics and Chemistry of the Earth, Parts A/B/C*, *32*(15), 1007-1014.

KILORWEMP (2017) Workshop on the assessment and use of natural resources in Kilombero Valley Ramsar Site – Fisheries diagnostic. Powerpoint presentation made on 31 January 2017. 47pp.

KILORWEMP (2016) Analysis of options for the consolidation of the Kilombero Game Controlled Area. Draft report. KILORWEMP Project Implementation Unit, Dar es Salaam, Tanzania. 60pp.

KILORWEMP PIU (2016) Report of the Regional Stakeholders Workshop on the consolidation of the Kilombero Game Controlled Area. Published report from the KILORWEMP Project, Dar es Salaam, Tanzania. 60pp.

KVOC (2017) ILUMA Biodiversity Interim Human Disturbance Report. Unpublished report produced by Kilombero Valley Ornithological Centre. 26pp.

Kwesiga, J., Neuhoff, D., Senthilkumar, K., Becker, M., & Köpke, U. (2016) Soil Management Options for Improving Nitrogen Use Efficiency of Rice in the Kilombero Flood Plains. *Conference Abstract: Solidarity in a competing world – fair use of resources*. Tropentag 2016, September 19-21, Vienna, Austria.

Madulu, N. F. (2004). Assessment of linkages between population dynamics and environmental change in Tanzania. *African Journal of Environmental Assessment and Management*, *9*, 88-102.

McInnes, R. J., & Everard, M. (2017). Rapid Assessment of Wetland Ecosystem Services (RAWES): An example from Colombo, Sri Lanka. *Ecosystem Services*, *25*, 89-105.

Mombo, F. M., Speelman, S., Van Huylenbroeck, G., Hella, J., Pantaleo, M., & Moe, S. (2011). Ratification of the Ramsar convention and sustainable wetlands management: situation analysis of the Kilombero

Valley wetlands in Tanzania. *Journal of Agricultural Extension and Rural Development*, *3*(9), 153-164.

Monson, J. (2012). From protective lions to angry spirits: environmental degradation and the authority of elders in the Kilombero Valley, Tanzania. *Journal of Eastern African Studies*, *6*(2), 336-350.

Munishi, P. K. T., Chuwa, J. J., Kilungu, H., Moe, S. R., & Temu, R. P. C. (2012) Management effectiveness and conservation initiatives in the Kilombero Valley Flood Plains Ramsar Site, Tanzania. *Tanzania Journal of Forestry and Nature Conservation*, *81*(2), 1-10.

Muro, J., Lopez, A., Strauch, A., Steinbach, S., Truckenbrodt, J. & Thonfeld, F. (2017) 25 years of landscape changes in the Kilombero floodplain, Tanzania. *Worldcover 2017 Conference*, 14-16 March 2017, European Space Agency-ESRIN, Frascati (Rome), Italy. Poster presentation.

Musamba, E. B., Ngaga, Y. M., Boon, E. K., Giliba, R. A., Sirima, A., & Chirenje, L. I. (2011). The Economics of Water in Paddy and Non-Paddy Crop Production around the Kilombero Valley Ramsar Site, Tanzania: Productivity, Costs, Returns and Implication to Poverty Reduction. *Journal of Agricultural Science*, *2*(1), 17-27.

Mwakaje, A. G. (2009). Wetlands, livelihoods and sustainability in Tanzania. *African Journal of Ecology*, *47*(s1), 179-184.

Mwakalila, S. (2008). Opportunities and challenges for sustainable water resources management in Tanzania. *The Geographical Journal*, *174*(2), 154-157.

Namaalwa, S., Funk, A., Ajie, G. S., & Kaggwa, R. C. (2013). A characterization of the drivers, pressures, ecosystem functions and services of Namatala wetland, Uganda. *Environmental science & policy*, *34*, 44-57.

Nindi, S. J., Maliti, H., Bakari, S., Kija, H., & Machoke, M. (2014). Conflicts over land and water resources in the Kilombero Valley floodplain, Tanzania. *African Study Monograph*. Supplement. 50, 173-190.

Ntongani, W.A. & Andrew S.M. (2013). Bird species composition and diversity in habitats with different disturbance histories at Kilombero Wetland, Tanzania. *Open Journal of Ecology*, *2013*.

Ntongani, W. A., Munishi, P. K., More, S. R., & Kashaigili, J. J. (2014). Local Knowledge on the Influence of land use/cover changes and

conservation threats on Avian community in the Kilombero Wetlands, Tanzania. *Open Journal of Ecology*, *4*(12), 723.

PINGO's Forum (2013). *Eviction of pastoralists from Kilombero and Rufiji valleys, Tanzania*. Available at: http://www.pingosforum.or.tz

Ramsar Convention (1999) Wetland risk assessment framework. Resolution VII.10. Available at http://www.ramsar.org/document/resolution-vii10-wetland-risk-assessment-framework [Accessed 11 December 2016]

Ramsar Convention (2002). Principles and guidelines for wetland restoration. Resolution VIII.16. Available at http://www.ramsar.org/document/resolution-viii16-principles-and-guidelines-for-wetland-restoration [accessed 9 December 2016].

Ramsar Convention (2005) A Conceptual Framework for the wise use of wetlands and the maintenance of their ecological character. Resolution IX.1 Annex A. Available at http://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_ix_01_annexa_e.pdf [accessed 11 December 2016].

Ramsar Convention (2008). Wetlands and river basin management: consolidated scientific and technical guidance. Resolution X.19. Available at: http://www.ramsar.org/document/resolution-x19-wetlands-and-river-basin-management-consolidated-scientific-and-technical [accessed 10 December 2016]

Ramsar Convention (2008a). *Wetlands and extractive industries.* Resolution X.26. Available at http://www.ramsar.org/document/resolution-x26-wetlands-and-extractive-industries [accessed 10 December 2016]

Ramsar Convention Secretariat (2010). *Managing wetlands: Frameworks for managing Wetlands of International Importance and other wetland sites*. Ramsar handbooks for the wise use of wetlands, 4th edition, vol. 18. Ramsar Convention Secretariat, Gland, Switzerland. Saunders, M. J.,

Richards, K., Brasington, J., & Hughes, F. (2002). Geomorphic dynamics of floodplains: ecological implications and a potential modelling strategy. *Freshwater Biology*, *47*(4), 559-579.

Smucker, T. A., Wisner, B., Mascarenhas, A., Munishi, P., Wangui, E. E., Sinha, G., Weiner, D., Bwenge, C. & Lovell, E. (2015). Differentiated livelihoods, local institutions, and the adaptation imperative: Assessing climate change adaptation policy in Tanzania. *Geoforum*, *59*, 39-50.

Sulle, E. (2016). Social Differentiation and the Politics of Land: Sugar Cane Outgrowing in Kilombero, Tanzania. *Journal of Southern African Studies*, 1-17.

Sundet G. (2005) The 1999 Land Act and Village Land Act – A technical analysis of the practical implications of the Acts. Working draft paper. 21pp.

Swala-Energy Company - http://www.ippmedia.com/frontend/index.php?l=61468; http://www.swala-energy.co.tz/assets-tanzania-kilosa_kilombero.php

Strauch, A.M. et al, (2016) Influence of forest management system on natural resource use and provision of ecosystem services in Tanzania, Article in Journal of Environmental Management 180:35-44 ·

Tanzania Wildlife Corridors WCS/TAWIRI - http://www.tzwildlifecorridors.org

TAWIRI (2011). *Evaluation f Game Controlled Areas in Tanzania, Phase 1: Loliondo and Kilombero*. Report produced by Tanzania Wildlife Research Institute on behalf of the Ministry of Natural Resources and Tourism. MNRT, Dar es Salaam, Tanzania. 73pp.

United Republic of Tanzania. Ministry of Natural Resources and Tourism Wildlife Division. Sustainable Wetlands Management Program. NWWG Workshop Proceedings. Lessons learnt in wetlands management: 10 years May 2013. For the establishment of Community Based Natural Resource Management of Wetlands

United Republic Of Tanzania. Prime Minister's Office. Southern Agricultural Growth Corridor of Tanzania (SAGCOT) Investment Project. Strategic Regional Environmental and Social Assessment (SRESA). December 2013 (URL: http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/02/07/000461832_20140207124056/Rendered/PDF/E30750V30REV0A00Box382146B00PUBLIC0.pdf

United Republic of Tanzania (URT) (2006) Water Sector Development Programme 2005-2025. Consolidated Document. Ministry of Water, Dar es Salaam, Tanzania. 200pp.

United Republic of Tanzania (URT) (2012) A National Sustainable Wetlands Management Guideline, Wildlife Division. Ed. Wetlands Unit. Published by Ministry of Natural Resources and Tourism, Dar es Salaam, Tanzania. 94pp.

United Republic of Tanzania (2013). Water Sector Development Programme 2007-2014: Evaluation of Phase I – Final Report. Report produced by Oxford Policy Management on behalf of the Ministry of Water, Dar es Salaam, Tanzania. 77pp.

United Republic of Tanzania (2013a). Southern Agricultural Growth Corridor of Tanzani (SAGCOT) Investment Project: Strategic Environmental and Social Assessment (SRESA). Published by the Prime Minister's Office, Dar es Salaam, Tanzania. 320pp.

United Republic of Tanzania (2014). National Report on the Implementation of the Ramsar Convention on Wetlands. Submitted to the 12th Meeting of the Conference of the Contracting Parties, Uruguay, 2015. Ramsar Convention: Gland, Switzerland. COP12. available on: http://www.ramsar.org/document/cop12-national-reports-united-republic-of-tanzania. Accessed 10 December 2016.

United Republic of Tanzania (2015) Intended Nationally Determined Contributions (INDCs). Submission to the United Nations Framework Convention on Climate Change, 29 September 2015. Downloaded from http://newsroom.unfccc.int/unfccc-newsroom/tanzania-submits-its-climate-action-plan-ahead-of-2015-paris-agreement/. Accessed 10 December 2016.

United Republic of Tanzania (2016a) Kilombero District Land Use Framework Plan 2016-2036. National Land Use Planning Commission & Kilombero District Council. 181pp.

United Republic of Tanzania (2016b) Malinyi District Land Use Framework Plan 2016-2036. National Land Use Planning Commission & Malinyi District Council. 113pp.

United Republic of Tanzania (2016c) Ulanga District Land Use Framework Plan 2016-2036. National Land Use Planning Commission & Ulanga District Council. 116pp.

USAID (2015) Starter documner: Hydrology Component – Rufiji Basin Environmental Flow Assessment. Report prepared by CDM International for USAID, Dar es Salaam, Tanzania. August 2015. 75pp.

USAID (2016) Environmental Flows in the Rufiji Basin Environmental Assessed from the Perspective of Planned Development in Kilombero and Lower Rufiji Sub-Basins. Final Report prepared by CDM International for USAID, Dar es Salaam, Tanzania. March 2016. 167pp.

van Dam, A., Kipkemboi, J., Zaal, F., & Okeyo-Owuor, J. B. (2011). The ecology of livelihoods in East African papyrus wetlands (ECOLIVE). *Reviews in Environmental Science and Bio/Technology*, *10*(4), 291-300.

Verhoeven, J. T., & Setter, T. L. (2009). Agricultural use of wetlands: opportunities and limitations. *Annals of Botany*, mcp172.

WREM International (2015). *Rufiji IWRMDP Final Report, Volume I: Rufiji IWRMD Plan*. Report prepared for the United Republic of Tanzania, Ministry of Water, by WREM International Inc., Atlanta, Georgia, USA, 206pp.

8. Annexes

8.1. The Ramsar Sites criteria

The nine criteria for identifying Wetlands of International Importance

Group A of the Criteria. Sites containing representative, rare or unique wetland types

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Group B of the Criteria. Sites of international importance for conserving biological diversity

Criteria based on species and ecological communities
Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Specific criteria based on waterbirds
Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.
Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Specific criteria based on fish
Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.
Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

Specific criteria based on other taxa
Criterion 9: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

8.2. RIS

To be downloaded from:
https://rsis.ramsar.org/RISapp/files/RISrep/TZ1173RIS.pdf

8.3. RAM Itinerary

DATE	TIME	PLACE	ACTIVITY
06 November 2016	**Sunday**	**Travel**	
07 November 2016	**Monday**	**DSM**	**Meetings**
	0900-1100	MNRT	Project team
	1100-1230	MNRT	D-WD Songorwa
	1400-1500	MNRT	PS (Milanzi)
08 November 2016	**Tuesday**	**DSM**	**Meetings**
	0900-1030	VPO	TBC
	1130-1300	M. Water	TBC (Director of Water Res)
		SAGCOT	CEO (Kirenga)
		BTC	BTC+EU
09 November 2016	**Wednesday**	**DSM**	**Meetings**
		LTSP/MLHHSD	NPC (Majabe)
		M. Agriculture	TBC
		Nat Land Use Pl. C.	DG (Nindi)
10 November 2016	**Thursday**		**Site visit**
	0700-1100	flight to Ifakara	survey
		Kilombero District Council	DED and DC
		KVRS Office	WD/PM (Jiday)
11 November 2016	**Friday**	**Mahenge**	**Site visit**
	0800-1400	travel to Mahenge	BMU and WMA stop
		Ulanga District Office	DED;DC
12 November 2016	**Saturday**	**Ifakara**	**Site visit**
		travel - site visit	site visit
13 November 2016	**Sunday**	**Ifakara**	**Site visit**
			workshop preparation
14 November 2016	**Monday**	**Morogoro**	
	0700-1100	Travel to Moro	
	1100-1200	RAS Moro	Reg. Comm; RAS
	1400-1500	TAWA	DG (Loiboki)
	1500-1600	SUA	(Mombo)
15 November 2016	**Tuesday**	**DSM**	**travel/preparation**
	0700-1200	Travel to DSM	
	1300-1700		workshop preparation
16 November 2016	**Wednesday**	**DSM**	**workshop**
	0830-1700		Workshop
	1830-2030		Cocktail reception
17 November 2016	**Thursday**	**DSM**	
	1000-1300	MNRT	wrap-up and debriefing
18 November 2016	**Friday**	**Travel**	**departures**

8.4. Detailed in-country itinerary

06/11	Rob and Ed	Depart London 06:00	Arrive Dar es Salaam 21:05
	Paul	Depart Geneve 07:25	Arrive Dar es Salaam 21:05

07-09/11 RAM consultations in Dar es Salaam with Government of Tanzania officials, BTC and other relevant Aid Agencies/Embassies, NGOs and other relevant organizations/individuals (proposed list to be agreed when dates are firm)

10/11 Travel to Kilombero Ramsar site
Aerial overflight of Kilombero Ramsar site and key catchment forests on the western escarpment,

11-15/11 RAM consultations with Government of Tanzania officials (local/ regional), local communities, Kilombero Sugar Company, Kilombero Valley Teak Company, local NGOs/CBOs
Return to Dar

16/11 RAM Policy Review Workshop with Government of Tanzania officials (local, regional and national) and invited participants from NGOs/ CBOs/private sector

17/11 Debriefing with GoT and BTC
RAM Team Departure

8.6. List of consultees

Name	Designation/Organization	Contact
Ramsar Advisory Mission Team		
Paul OUEDRAOGO	Ramsar Secretariat-Senior Advisor for Africa	ouedraogo@ramsar.org +41 22 999 0164
Edward Wilson	Consultant at Sisyphus Natural Solutions	ewilson@sisyphusnaturalsolutions.com
Robert Mclnnes	Environmentalist at RM Wetlands and Environmental Ltd.	rob@rmwe.co.uk +44 (0) 1367 248081
Damas Patrick Mbaga	Hydrologist at African Wildlife Foundation	PDamas@awf.org +255 745 847451
National Irrigation Commission		
Eng. Seth Lusemwa	Director General	
Eng. Lait Simkanga	Environmental Engineer	simukanga@gmail.com +255 754 271175
Vice President's Office		
Eng. Ngosi Mwihava	Acting Permanent Secretary	
Ester Makwaia	Assistant Director (Environmental and Natural Habitat Conservation)	
Magdalena J. Mtenga	Assistant Director (Environmental Pollution Control Section)	+255 754 467301
Alhaji Selemani Kisimbo	Desk officer Environmental	+255 753 880889
Ministry of Natural Resources and Tourism		
Donatius M.K. Kamamba	Director of Antiquities	+255 22 2864258
Prof. Alexander Songorwa	Director of Wildlife Division	+255 222866418
Pallage F. Kauzeni	National Project Coordinator-KILORWEMP	+255 786 485415
Ministry of Water and Irrigation		
Silvester Matemu	Acting Director of Water Resources	+255 754 564424
Dr. George Lugomela	Assistant Director Planning and Research	lugomela@yahoo.com +255 755 778306
Peter Mdalangwila	Hydrogeologist	+255 713 396591
Hamza Singano	Hydrologist	+255 717 033820
National Land use Planning Commission (NLUPC)		
Dr. Stephen Justice Nindi	Director General	
Suzane Mapunda	Researcher	+255 782 144466
Ifakara District Council, Ramsar site and KILORWEMP Staff		
Iluma Wildlife Management Area (Iluma-WMA) leaders		
Mgeregembe Beach Management Unit (Mgeregembe-BMU) leaders		
Ulanga District Council and KILORWEMP Staff		
Igumbiro Village		
Mohamedi Abdallah	Village Chairman	
Omari Katikula	CBO-Iluma	
Iddi Nassoro Kilimila	Farmer	
Msham Mohamedi	Farmers Chairman	
Eliuta Ngalapa	Iluma-WMA Secretary	
Mohamedi Kimbunga	Farmer	
Bihawa Issa Kilola	Women representative	
Tatu Thabiti	Women representative	
Safia Hamisi	Women representative	
Zuhura Ngamange	Women representative	
Tabia Kachela	Women representative	
Amina Mtumbi	Women representative	
Mofu Village Kilombero District		
Alvinus Ngwila	Member	
Fintan Ngajimala	Chairman SHIHIMAMU	
Amran Hamidu Seki	Member	
Raphael Mbaruka	Member	
Adeliki Mpuigi	Village Executive Officer	

Morogoro Regional Secretary Office		
Eng. Dr. John S. Ndunguru	Regional Administrative Secretary (RAS)	+255 754 565455
Joseph Chuwa	Regional Natural Resources Officer (RNRO)	+255 755 858803
Jonas Mlala	TFS-Eastern Zone Area	
Sokoine University of Agricultural		
Prof. Pantaleo Munishi	Professor Dep. of Forest	+255 754 591849
Dr. Felister Mombo	Dep. Of Forest Economics	f.mombo@yahoo.com fmombo@suanet.ac.tz +255 785 252550
CDM Smith-Project office Morogoro		
Keith Williams	Team Leader	williamskf@cdmsmith.com +255 784 722939
Godfrey Kashasha	Irrigation Engineer	+255 713 502188
Belgium Technical Cooperation		
Giuseppe Daconto	Inter. Tech. Assistant-BTC	+255 685 710724

8.7. Workshop Report

(See separate file)