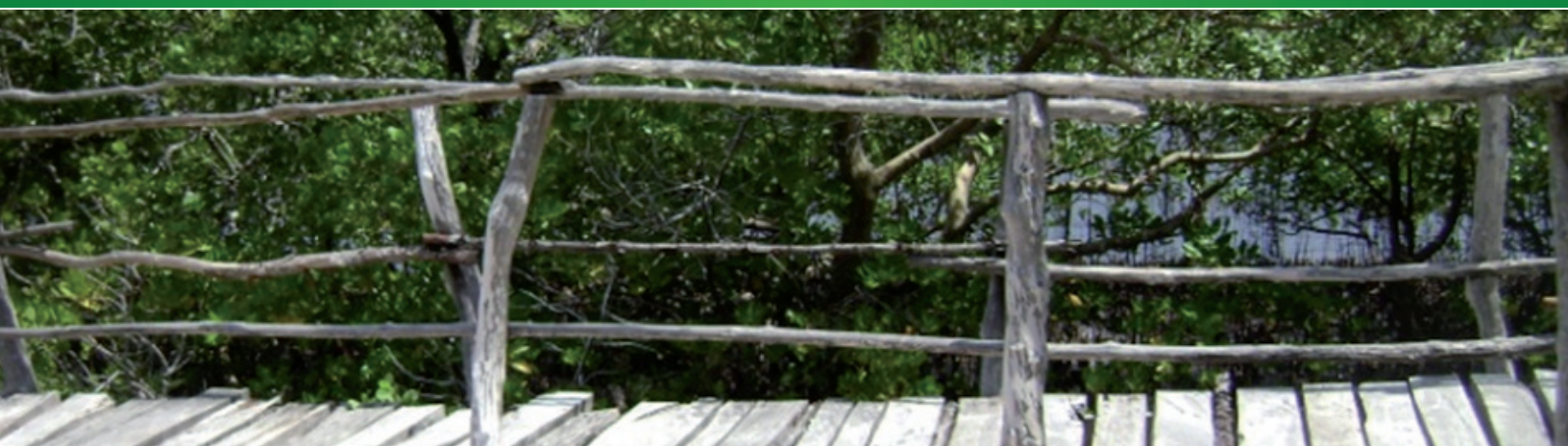




A PLATFORM FOR STAKEHOLDERS IN AFRICAN FORESTRY

SCOPE, POTENTIAL AND IMPLEMENTATION OF MITIGATION ACTIVITIES IN MANGROVES FORESTS IN EASTERN AND SOUTHERN AFRICA



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Scope, potential and implementation of mitigation activities in mangrove forests in eastern and southern Africa

Rukia Kitula

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Acronyms and abbreviations

AFF	African Forest Forum
CBFM	Community Based Forest Management
CBOs	Community Based Organizations
CCIAM	Climate Change Impacts, Adaptation and Mitigation
CFA	Community Forest Association
CoFMAs	Community Forest Management Agreements
CPR	Common Property Resources
CSOs	Civil Society Organizations
DCCFF	Department of Commercial Crops, Fruits and Forestry
DFNR	Department of Forestry and Non-Renewable Natural Resources
DoE	Division of Environment
FAO	Food and Agriculture Organization
FBD	Forestry and Beekeeping Division
FGDs	Focus Group Discussions
FVPO	First Vice President's Office
GHG	Greenhouse gases
GIS	Geographic Information System
HIMA	<i>Hifadhi ya Misitu ya Asili</i> (Swahili for Conservation of Natural Forests)
IFPRI	International Food Policy Research Institute
IPCC	International Panel on Climate Change
IRA	Institute of Resources Assessment
IUCN	International Union for Conservation of Nature
JECA	Jozani Environmental Conservation Association

JFM	Joint Forest Management
KK	<i>Kilimo Kwanza</i>
KMFRI	Kenya Marine and Fisheries Research Institute
LPG	Liquid Petroleum Gas
MACEMP	Coastal Environmental Management Project
MDGs	Millennium Development Goals
MMP	Mangrove Management Project
MRV	Monitoring, reporting and verification
NAFORMA	National Forestry Resources Monitoring and Assessment
NCCSC	National Climate Change Steering Committee
NCCTC	National Climate Change Technical Committee
NCMC	National Carbon Monitoring Centre
NGO	Non-Governmental Organizations
NORAD	Norwegian Agency for Development
NPK	Nitrogen-Phosphorus-Potassium
NRF	National REDD+ Fund
NRTF	National REDD+ Task Force
NTFP	Non-timber forest products
NWFP	Non-wood forest products
PES	Payment for ecosystem services
PFM	Participatory Forest Management
PRA	Participatory Rural Appraisal
PS	Permanent Secretaries
RAS	Regional Administrative Secretariat
REDD	Reduced Emissions from Deforestation and forest Degradation

REDD+	Reduced Emissions from Deforestation and Degradation, plus the role of conservation, sustainable forest management, and forest carbon stock enhancement
REMP	Rufiji Environmental Management Project
RSC	REDD+ Steering Committee
RUMAKI	<i>Rufiji-Mafia-Kilwa</i>
SACOS	Saving and credit societies
SONARECOD	Society for Natural Resources Conservation and Development
SUA	Sokoine University of Agriculture
TASAF	Tanzania Social Action Fund
ToTs	Training of Trainers
TWGs	Technical Working Groups
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCCs	Village Conservation Committees
VNRCs	Village Natural Resources Committees
VPO	Vice President's Office
WBS	Wood Biomass Survey
WWF	World Wide Fund for Nature

Executive summary

Reduced Emissions from Deforestation and Degradation, plus the role of conservation, sustainable forest management, and forest carbon stock enhancement (REDD+) is a policy initiative developed by the international community to counteract the loss of forests and to provide incentives against deforestation in developing countries. With this new international mandate to tackle deforestation and forest degradation, this report was developed for the African Forest Forum (AFF) 'African forests, people and climate change project' to evaluate the scope, potential and implementation of mitigation activities in mangrove forests in Eastern and Southern Africa. It was considered important to contribute to the understanding of the role of mangrove carbon credits to the livelihood of local communities and to sustain biodiversity and improve the quality of the environment. This also led to recommendations for further studies and formulation of REDD+ policies and programmes aiming at increasing equity and enhancing carbon stock in mangrove forests.

The study revealed that REDD+ activities implemented in mangrove forests in Kenya and Tanzania were basically readiness and demonstration. These activities were implemented at all levels and they were not specific to mangrove forests. Various institutional arrangements were established at all levels to provide enabling environments for implementation of REDD+ activities in mangrove forests. *Mikoko Pamoja* and *Hifadhi Misituya Asili* were the only two active REDD+ pilot projects in mangrove forests in Kenya and Tanzania, respectively. The potential for increasing REDD+ activities in mangrove forests was evaluated based on effectiveness, efficiency, equity and co-benefits of pilot projects in carbon sequestration and in reducing emissions. The REDD+ pilot projects performed fairly well in the area of disseminating information on the REDD+ concept and on climate change in mangrove forests to wider communities. They were also ranked effective on capacity building because they trained village conservation committees on various methods to carry out REDD+ activities effectively. In addition, communities had high expectations on REDD+ pilot projects in providing economic incentives and support livelihood improvements to reduce pressure in mangrove forests.

The REDD+ pilot projects were rather efficient in supplementing efforts by the Kenya and Tanzania governments to protect and conserve mangrove forests, including being important in relieving expenditures of the governments in such efforts. It was found that the REDD+ pilot activities were implemented within existing networks of communities engaged in participatory forest management, thereby significantly reducing monitoring, enforcement and other costs. Despite the presence of permit systems, illegal activities in mangrove forests were escalating in the study areas, indicating that monitoring of rules of compliance by the community members was poorly enforced. This contributed to increased deforestation and degradation of mangrove forests. The REDD+ projects are concerned

with providing all groups in the communities with incentives for more sustainable forest use, a strategy that is likely to increase a sense of ownership to the mangrove REDD+ projects and therefore contributing to preventing emissions of GHGs in mangrove forests.

The evaluation of co-benefits of mangrove REDD+ projects was based on the four dimensions of forest conservation, political change, socio-economic benefits, and adaptation to climate change. Regarding forest conservation, the study showed that mangrove tree planting was done to encourage reforestation, hence enhancing carbon stock. Some mangroves were retained on farms to ensure expansion and regeneration of mangrove resources. However, forest conservation was facing a big challenge as pressure placed on mangrove forests for firewood was high due to the increased population and use of traditional cooking stoves. In the area of political change, communities had low expectations from REDD+ projects to contribute to desired political change as officials and conservation committees were not accountable for forest protection, neither were they transparent and they were weak in applying the rule of law. Some of the pre-conditions for increased implementation of REDD+ activities in mangrove forests were found to be: proper signing of agreements, developing national REDD+ strategies, clear project eligibility, in-depth preparatory studies, knowledge on drivers of deforestation and degradation, leakage prevention activities, capacity building, and establishing carbon baselines for REDD+ projects.

Forest restoration was the best REDD+ practice in mangrove forests with regards to its contribution to climate change mitigation as it ranked first with a score of 45. Other climate change mitigation practices were: sustainable forest management, raising community income generation, boundary demarcation and social fencing, strengthening forest land tenure, strengthening community based organizations, avoided deforestation, support exchange visits, establishment of woodlots, and climate change awareness workshops. Agricultural and fishing intensification with a score of 38 was the best activity in mitigating the impacts of climate change in mangrove forest. Other contributing activities were: developing appropriate management plans, participatory management, enforcement of forest law and regulations, opening and closing system, community based eco-tourism, taungya system, enforcement of land use laws and regulations, sacred groves, and international reputation. In conclusion, there was considered to be a high potential for increased implementation of REDD+ activities in mangrove forest to reduce GHG emissions to the atmosphere. Currently, in mainland Tanzania, there are no REDD+ pilot projects *per se* in mangrove forests. Those found were just research projects for academic purposes. Therefore, REDD+ pilot projects in mangrove forests in mainland Tanzania should be encouraged because communities are willing to benefit from this new funding initiative.

CHAPTER 1 Introduction

Mangrove forests occupy intertidal areas of tropical and subtropical coastal regions worldwide. On a global basis, they cover about 24 million ha of which over 3.2 million ha are in Africa (FAO, 2007). They play important roles in regulating services such as protection of coastlines from storm surges, erosion and floods, land stabilization by trapping sediments, and water quality maintenance (Wagner, 2008). They also provide goods and services, such as subsistence and commercial fisheries, honey, fuelwood, building materials, and traditional medicines. Cultural services offered by mangrove forests include tourism, recreation and spiritual appreciation, while environmental services include cycling of nutrients and provision of habitats for plant and animal species (Kauffman and Donato, 2012). Mangrove forests are also an important carbon sink in the tropics (Nellemann *et al.*, 2009).

Most carbon in mangrove forest ecosystems is either stored below ground in local and adjacent sediments or in above-ground forest biomass. Mangrove forests act as net carbon sinks when their area and/or productivity increase, resulting in an increased uptake of carbon dioxide (CO₂) from the atmosphere (carbon sequestration). Mangrove forests absorb CO₂ and release oxygen into the atmosphere through photosynthesis in which CO₂ is converted into carbon and stored in the woody tissue (biomass) of the plant. Through this process, some forms of mangrove forest management can be used for CO₂ sequestration thereby contributing to climate change mitigation. Three different global estimates for carbon uptake within mangrove systems all converge on a value equivalent to $\sim 18.4 \times 10^{12}$ g C yr⁻¹ when applying a global area figure of 160 000 km² (Kauffman and Donato, 2012). It is not known why this area figure, which equals 16 million ha, differs from the figure from FAO quoted above. In comparison to other tropical forests, mangroves have actually been found to be more efficient at carbon sequestration (Laffoley and Grimsditch, 2009).

On the other hand, mangrove forests act as a source of carbon emissions when burned or when they decay. When mangrove soil is disturbed it releases CO₂ and other greenhouse gases into the atmosphere. Up to 10% of total global deforestation emissions are from mangrove forests despite covering just 0.7% of the tropical forest area (Donato *et al.*, 2011). The Intergovernmental Panel on Climate Change (IPCC) estimates that the cutting down and degradation of forests is contributing close to 20% of total greenhouse gases entering the atmosphere. The world's mangroves are disappearing at an alarming rate (FAO, 2007). From the 1960s to the 2000s they declined in area by 50%. Regionally, Asia has lost 61% and Africa 55% of their mangrove areas (Macintosh and Ashton, 2002). According to a mangrove assessment report (FAO, 2007), the world's mangroves declined to about 3.6 million ha between 1980 and 2005, which is equivalent to a 20% loss of total mangrove

area. It is estimated that the annual global rate of mangrove loss continues to be 1-2% (Spalding *et al.*, 2010). Between 1981 and 2000, Kenya lost about 15% of its mangroves coverage (King, 2012), and in Tanzania, there has been an annual decline rate of c. 1.3% in the last two decades (Wang *et al.*, 2003). Not only does this endanger biodiversity and the livelihoods of forest dependent communities, it is a significant factor contributing to global climate change. Thus, there is an urgent need to reduce mangrove deforestation, degradation, and associated emission of greenhouse gases (GHGs).

In order to counteract the loss of mangrove (and other) forests and to provide incentives against deforestation, the international community has responded by developing a policy initiative to Reduce Emissions from Deforestation and Degradation, plus the role of conservation, sustainable forest management, and forest carbon stock enhancement (REDD+), in developing countries (UNFCCC, 2009). Initially, preparations of REDD+ activities have focused on terrestrial forests, mainly rain forests. Recent estimates indicate, however, that mangroves are among the most carbon rich forests in the tropics and thus play important role in the global climate cycle (Donato *et al.*, 2011). Mangroves are thus clearly an option to focus on for countries interested in developing REDD+ readiness plans.

With the new mandate to tackle deforestation and forest degradation, and identifying resources dedicated to promoting REDD+, there is a need for detailed studies to evaluate the scope, potential and implementation of mitigation activities in mangrove forests in Eastern and Southern Africa. This was done to generate useful information within the African Forest Forum (AFF) initiated project “African forests, people and climate change”, aiming at strengthening and furthering the forest/climate nexus for Africa’s future development. The findings from this study will contribute to understanding the role of mangrove carbon credit to livelihoods of local communities and to protection and conservation of mangrove forests. The study also recommends further studies and formulation of REDD+ policies and programmes that aim at increasing equity and enhancing mangrove forest carbon stock.

CHAPTER 2 Methodology

STUDY AREAS - JUSTIFICATION AND LOCATIONS

Countries with mangrove forests in Eastern and Southern Africa are Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa and Tanzania (Kathiresan and Rajendran, 2005; FAO, 2009). Of these, only Kenya, Madagascar, Mozambique, South Africa and Tanzania have ratified the Climate Change Convention. Kenya, Madagascar and Tanzania have already initiated REDD+ pilot projects in mangrove forests to help reduce deforestation and forest degradation and achieve GHG emission reductions. Only Kenya and Tanzania were selected for the detailed study reported here. In Kenya, data were collected in Gazi Bay (Gazi and Makongeni villages). In Tanzania, data were collected in the Rufiji Delta (mainland Tanzania) and on Unguja Island. In each area, two villages participating in REDD+ pilot projects in mangrove forest were selected for the study. These villages were Mchinga and Mfisini villages in the Rufiji Delta and Cheju and Pete villages in Unguja Island. These sites permitted collection of sufficient data important for the study.

The Gazi Bay

The Gazi Bay is located at 4°25'S and 39°50'E (Figure 1). It is situated on the south coast of Kenya about 55 km from Mombasa (Kairo, 2001) and is bordered by 6.2 km² of mangrove forests. Ten mangrove species grow in Kenya, viz. *Avicennia marina*, *Lumnitzera racemosa*, *Pemphis acidula*, *Xylocarpus granatum*, *X. moluccensis*, *Bruguiera gymnorhiza*, *Ceriops tagal*, *Rhizophora mucronata*, *Sonneratia alba* and *Heritiera littoralis*. There are two wet seasons, in March-May and October-November. Most people in the area are artisanal fishers and small scale agriculturalists. The main ethnic group is the Swahili, with the Mijikenda of Bantu origin being the second commonest.

The Rufiji Delta

The Rufiji Delta is located at 7°47' to 8°03' S and 38°62' to 39°17' E (Figure 2). It covers about 72 000 ha and forms part of the large Rufiji river basin, which has an overall mean altitude of less than 500 metres. Mangroves cover around 53 000 ha of the delta (Semesi, 1991), the largest mangrove forests on the East Coast of Africa. Most villages in the Rufiji Delta are only accessible by boat. The climate of the area is tropical, with temperatures between 24°C and 31°C throughout the year and two rainy seasons, short rains (October to December) and long rains (March to May) and with rainfall ranging from 800 to 1 000 mm (Shaghude *et al.*, 2004). The mangrove forests of the Delta are composed of eight species, viz. *Rhizophora mucronata*, *Sonneratia alba*, *Ceriops tagal*, *Lumnitzera racemosa*,

Avicennia marina, *Bruguiera gymnorhiza*, *Heritiera littoralis* and *Xylocarpus molluccensis* (Turpie, 2000; Wagner, 2008).

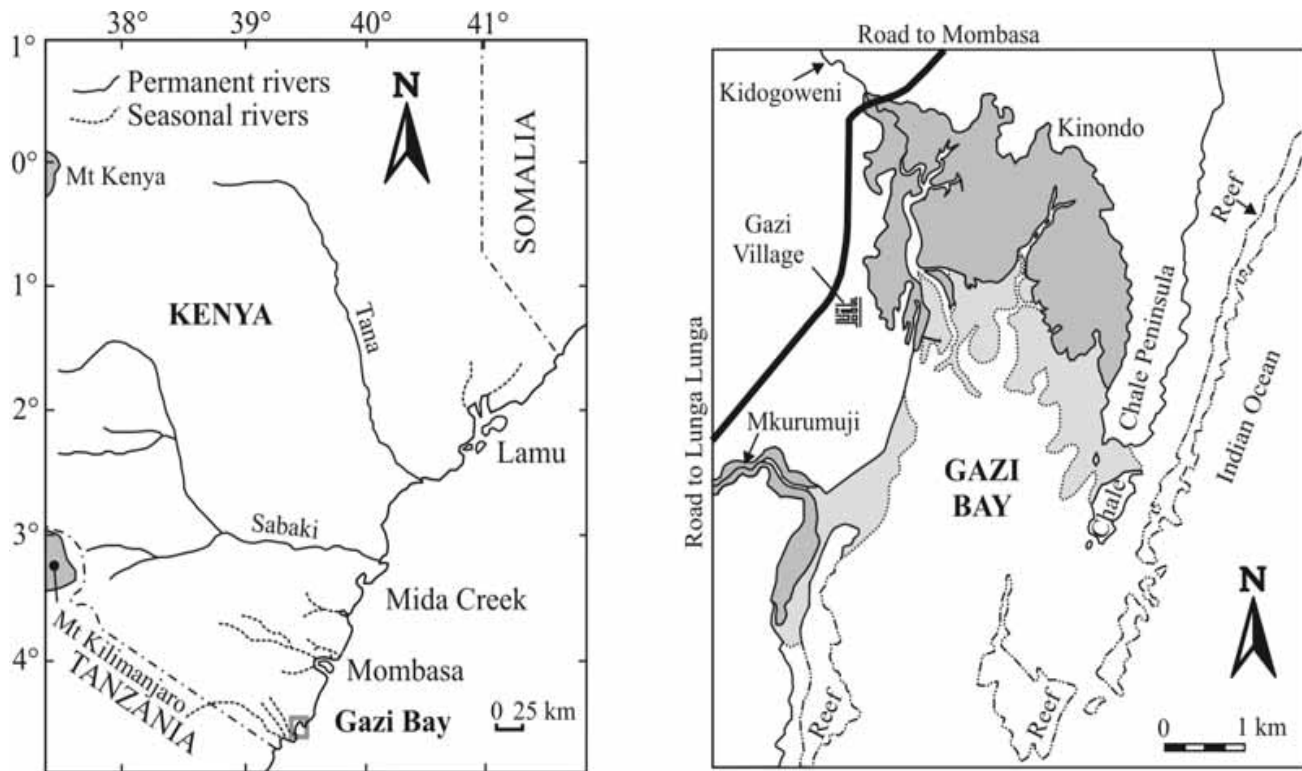


Figure 1. Map of the Gazi Bay, Kenya (Bosire *et al.*, 2003)

Unguja Island

Unguja Island is situated in the Indian Ocean about 40 km east of Bagamoyo on the Tanzanian mainland (Figure 3). The climate is tropical and maritime, and is characterised by monsoon winds and a binomial rainfall pattern. The main rain season occurs between March and June, and the short rains starts in October and ends in December. However, some inter-monsoonal precipitation takes place. The average annual rainfall for the island is c. 1 500 mm. The highest temperature in the area is 33°C and minimum temperature is 23.3°C. It has a population of close to 625 000 (URT, 2002). Ethnic groups on Unguja Island include Shirazi groups of Wahadimu, Wapemba and Watumbatu, Arabs, Asians (Indians and Pakistanis), Comorians, and people from the mainland of Tanzania. Species of mangroves found in the area include *Rhizophora mucronata*, *Bruguiera gymnorhiza*, *Ceriops tagal*, *Xylocarpus spp.*, *Heritiera littoralis*, *Avicennia marina*, *Lumnitzera racemosa*, *Sonneratia alba*, and *Pemphis acidula*.

DATA COLLECTION METHODS

The sampling unit in this study was a household. A questionnaire (Annex 1) was the main research instrument for collecting primary data from households and it included both open and close-ended questions. Thirty households were interviewed in each study village to gather information on scope, potential and implementation of mitigation activities on mangrove forests. The questionnaires were administered by both the consultant and research assistants. Participant observations was among the instruments used for data collection because the method helped the consultant and research assistants to gain more understanding on the climate change mitigation measures applied in the area for the purposes of mangrove forest conservation and livelihood improvements. Also, the method enabled the consultant to tie together discrete elements and information collected by other methods.

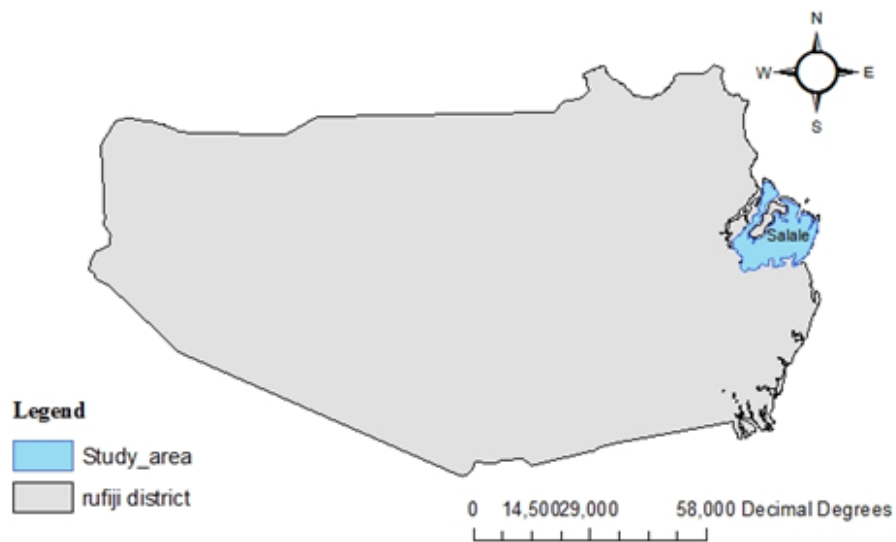


Figure 2. Map of the Rufiji District Tanzania showing study ward (Kitula, 2012)

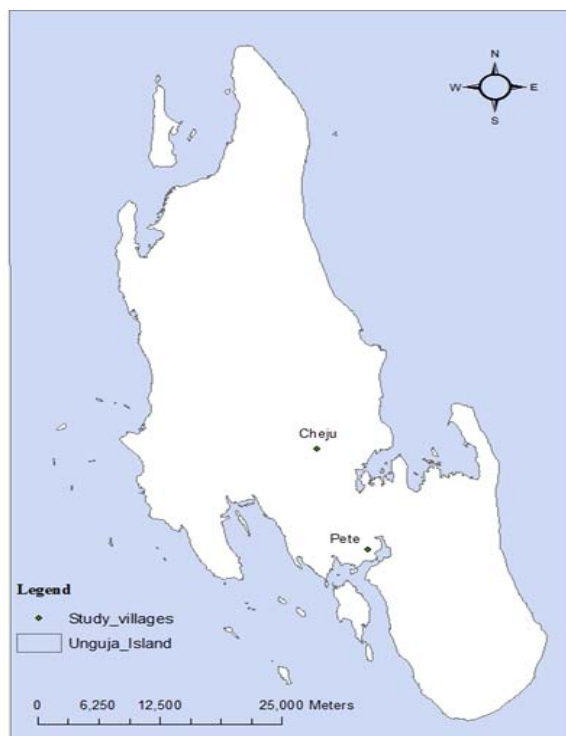


Figure 3. Map of the Unguja Island Tanzania showing study villages (Kitula, 2012)

Focus Group Discussions (FGDs) were conducted with six village conservation committees to gather information on REDD+ activities for mangrove forest conservation and livelihood improvements. A checklist of questions to guide FGDs is attached as Annex 2. Participatory Rural Appraisal (PRA) approaches including pair-wise ranking and scoring, transect walks and trend analysis were carried out to collect information on how climate change mitigation strategies have been implemented for conservation of mangrove forests and livelihood improvements. Discussions were held with key informants to obtain information that assisted in clarifying or improving understanding of particular issues or problems that were raised in PRA exercises, participant observations and questionnaire surveys.

Key informants interviewed in Tanzania included:

- ▶ The REDD+ Task Force;
- ▶ The National Forestry Resources Monitoring and Assessment (NAFORMA) project coordinator in Tanzania;
- ▶ The World Wide Fund for nature (WWF) REDD+ coordinator;
- ▶ Officials at WWF's Tanzania Office Programme responsible for climate change mitigation issues in the Rufiji Delta;

- ▶ CARE International Officials in Unguja Island;
- ▶ The *Hifadhi Misitwa ya Asili* (HIMA) project coordinator;
- ▶ Agricultural Extension Officers;
- ▶ Beekeeping Officers;
- ▶ The District Land, Environment and Natural Resources Officer;
- ▶ The Forest Officer in Unguja Island;
- ▶ The Mangrove Management Project (MMP) Officer; and
- ▶ Land Surveyors.

In Kenya, key informants interviewed were officials from the Mikoko Pamoja project and the Kenya Marine and Fisheries Research Institute (KMFRI). Questions asked reflected issues related to their role in addressing climate change impacts for conservation of mangrove forests and promoting community livelihoods. They were also requested to suggest possible solutions that are relevant for mitigating climate change impact in mangrove forests and their potential for up-scaling. A checklist of questions was used in guiding the discussions with key informants (Annex 3). Data on the status of mangrove forests were collected through Geographic Information System (GIS) data acquisition techniques and PRA approaches (trend analysis and transect walks). Journal articles, published and unpublished reports and newsletters were reviewed so as to have more insight on the extent of activities that have been implemented by various stakeholders to address climate change mitigation measures in mangrove forests.

DATA PROCESSING AND ANALYSIS

Content analysis was used to analyse qualitative information that were collected through PRA exercises, discussions with key informants, participant observations and documentary reviews. The qualitative data from PRA exercises were analysed in the field in collaboration with the communities. Descriptive statistical analysis was carried out for quantitative data. The potential for increased implementation of REDD+ activities in mangrove forests were assessed based on four criteria developed by Stern (2008). Performance of the best REDD+ practices on mangroves were measured by ranking and scoring methods. The free listing and ranking and scoring methods were used to identify other relevant climate change mitigation activities in mangrove forests.

Change detection was carried out with three windows data sets: 1980-1990, 1990-2000 and 2000-2010. Landsat TM/ETM+ free from clouds were used. Image processing involved two stages, viz. image geo-referencing and image enhancement, using ERDAS IMAGINE 9.1

software. Geo-referencing was done in order to correct distortions in images resulting from the image acquisition processes. Images were re-coded to the UTM-Coordinate system, while image enhancement was done to improve the radiometric, spectral and spatial resolutions, which are used for features discriminations. The two main image classifications used in this study were the unsupervised classification, which is a fully automated digital classification, and supervised classification, which is semi-automated utilizing the visual and ground truth data for image class land cover identifications and classifications. A supervised classification with a maximum likelihood classifier algorithm was carried out. Ground truth was obtained by gathering information about the area using topographical maps. A hand held GPS was used to identify or locate various features and land cover/use classes.

Final image classifications involved the use of reference data such as ground truth coordinates, Google earth and topographical maps. This data was used for verifications and updating of classified images and hence reduced errors from preliminary classifications. The estimation for the rate of change for different land use and cover was computed by using the following formulas:

$$\%Change_{yearx} = \frac{Area_{yearx} - Area_{yearx+t}}{Area_{yearx}} \times 100\% \dots\dots\dots(1)$$

$$Rateof\ change = \frac{Area_{yearx} - Area_{yearx+t}}{Area_{yearx} \times t_{year}} \times 100\% \dots\dots\dots(2)$$

Where: $Area_{yearx}$ = area of cover at the first date

$Area_{yearx+t}$ = area cover at the second date

t_{year} = period in years between the first and second scene acquisition dates

CHAPTER 3 National and sub-national REDD+ activities implemented in mangrove forests

The REDD+ started as a global initiative (Angelsen, 2008). The focus of REDD+ actions has today moved more to national and local levels and they are normally implemented in three phases: readiness, demonstration and implementation (Gichu, 2010; URT, 2010; Angelsen *et al.*, 2011). The study revealed that REDD+ activities implemented in mangrove forests in Kenya and Tanzania were basically readiness and demonstration. They were found to be implemented at national, sub-national and local levels and they were not specific to mangrove forests only. The REDD+ readiness activities were found to be done at national and sub-national levels, associated with measures and mechanisms necessary to establish an enabling framework for implementation of REDD+ in mangrove and other forests. REDD+ demonstration activities were done at local level, involving piloting with mechanisms that can reduce mangrove forest emissions in preparation for the period of conditional carbon deals. The following are the REDD+ readiness and demonstration activities that were mentioned during the survey to be implemented in mangrove forests and other forest types at all levels:

REDD+ ACTIVITIES IN MANGROVE FORESTS AT NATIONAL LEVEL

Setup of institutional arrangements for REDD+ systems in mangrove forests

The success of implementation of a mangrove REDD+ project is principally a function of institutional arrangements (CARE, 2010; Gichu, 2010; URT, 2010; Angelsen *et al.*, 2011; URT, 2012). Institutional arrangements refer to the way in which powers and functions of stakeholders are structured in order to implement mangrove REDD+ project activities. In other words, they are the various processes actors make collective decisions about to prepare the ground and build capacities for the implementation of the projects (Angelsen, 2008; Wertz-Kanounnikoff and Kongphan-apirak, 2009). It was found that various institutional arrangements were set up to provide enabling environments for implementation of REDD+ pilot projects. This means that developing carbon projects requires an understanding of the relevant stakeholders involved directly and indirectly in the forest sector. This helps to determine how carbon rights can be secured and managed on a long-

term basis. Below follows information regarding activities under institutional arrangements for REDD+ readiness systems in Kenya and Tanzania.

Institutional arrangements for REDD+ readiness systems in Kenya

The Kenya Forest Service (KFS) was designated as the body responsible for coordinating REDD+ readiness activities in Kenya and established a secretariat for the purpose, consisting of representatives from each of its core management programmes, i.e. Natural Forest Conservation and Management, Industrial Forest Plantations, Farm Forestry and Extension, and the Drylands Forestry Development Programme (Gichu, 2010).

In Kenya, the National REDD+ Steering Committee (RSC) was established to deal with policy guidance and implementation of the following REDD+ activities:

- ▶ National coordination of inter- and intra-sectoral REDD+ activities;
- ▶ Approval of REDD+ work plans and budgets;
- ▶ Resource mobilization;
- ▶ Assurance of timely delivery of a national REDD+ strategy, national reference emission level and an effective carbon monitoring system;
- ▶ Monitoring and evaluation;
- ▶ Quality control of REDD+ preparedness deliverables; and
- ▶ Provide mechanism for international collaboration with other REDD+ processes.

The National RSC membership is composed of:

- ▶ Permanent Secretaries (PS) from the Ministries of Forestry and Wildlife, Environment and Mineral Resources, Energy, Local Government, Planning, Finance;
- ▶ Directors of Kenya Forest Service (KFS), Kenya Marine and Fisheries Research Institute (KMFRRI) and National Environment Management Authority (NEMA);
- ▶ International Union of the Conservation of Nature (IUCN);
- ▶ World Wide Fund for Nature (WWF);
- ▶ Kenya Forests Working Group (KFWG);
- ▶ Representative from Universities;
- ▶ UNDP/UNEP; and,

► The Donor Coordination Group.

A National REDD+ TWG was established in Kenya to play an advisory role for the National RSC. The TWG also liaise directly with the National REDD+ Coordination Office, whose mandate is to operationalize the Readiness Preparation Proposal (R-PP).

In Kenya, the National REDD+ Coordination Office (NRCO) was first set up as an Interim National REDD+ Coordinator. The Coordinator opened up for the positions - full time subject matter specialists, administration and support staff - required in the implementation period of the R-PP. The NRCO is also supported by consultants or short-term staff seconded from relevant Ministries or government bodies. Specialist civil society (CSOs), non-governmental (NGOs) and community based (CBOs) organisations were also identified for collaborating in implementing certain components of the R-PP. Together, they are responsible for:

- coordination of work carried out by the five REDD+ Component Task Forces;
- communications of the overall REDD+ process and consultation support to the REDD+ component task forces;
- conflict resolution and grievances management;
- liaison and coordination with local conservancy officers who are the field based arm of the REDD+ strategy component task forces;
- finance management for monitoring incoming funds to REDD+ activities, and tracking expenditures during R-PP implementation; and,
- Oversight for particular gender concerns for all aspects of R-PP implementation.

The NRCO liaises with both the Task Forces and Local Conservancy Officers to evaluate needs for scaling up the strategy nationally. The REDD+ Component officers and local conservancy officers liaise with the National REDD+ Coordinator who structures proposals that are submitted to the TWG for evaluation. Advice from this TWG to the REDD+ Steering Committee enables it to make decisions in the context of broader multi-sectoral objectives given interministerial participation in the RSC.

The bulk of the funding to support the R-PP implementation phase flow through the Government of Kenya (GoK) Treasury, to the Ministry of Forestry and Wildlife, and the REDD+ Finance Management Unit located within the NRCO.

Institutional arrangements for REDD+ readiness systems in Tanzania

In Tanzania, the Division of Environment (DoE) in the Vice President's Office (VPO) was appointed to be responsible for coordination of climate change adaptation and mitigation

issues. Reducing emissions from deforestation and forest degradation (REDD) is one of the mitigation options to address climate change.

In Tanzania, the National Climate Change Steering Committee (NCCSC) was established to advise the government on all climate change related issues. The NCCSC is also responsible for providing overall guidance and supervision on the implementation of the REDD+. It is an inter-ministerial committee comprising PSs from sector ministries responsible for Energy, Finance, Industry, Natural Resources, Justice and Constitutional Affairs, Land, Agriculture, Livestock Development, Foreign Affairs and International Cooperation.

The National Climate Change Technical Committee (NCCTC) was established to oversee all technical issues related to the implementation of climate change issues, including the implementation of the National REDD+ Strategy. This committee is made up of Directors of the ministries comprising the NCCSC.

The National REDD+ Task Force (NRTF) was appointed to oversee implementation of technical and operational issues related to REDD+ readiness in Tanzania. It is an interim arrangement which will eventually be replaced by more permanent structures such as the NCCTC. The NRTF coordinates all REDD+ related activities in the country. Members of the NRTF are officials from the DoE and Forestry and Beekeeping Division (FBD). The Institute of Resource Assessments (IRA) of the University of Dar es salaam was appointed as facilitator and secretariat for the REDD+ readiness process to assist the NRTF.

The Government of Tanzania (GoT) is planning to establish a National Carbon Monitoring Centre (NCMC) to provide technical services on measuring, reporting and verification of REDD+ activities across the country. The centre will be a depository of all data and information concerning REDD. The centre will be overseen by the ministry responsible for climate change. Discussions within NRTF indicated that the Sokoine University of Agriculture (SUA) will serve as the NCMC.

In order to ensure a transparent mechanism for receiving and handling REDD funds, Tanzania needs to establish a National REDD+ Fund (NRF) (URT, 2009). The process to launch NRF at the Dept. of Public Service Management is underway. The major role of this institution is to consolidate and distribute funds to different stakeholders based on efforts in implementing the REDD+ strategy. It will operate at the national level. The fund will observe issues of transparency and accountability. Also, the performance of past forest revenue management systems, benefit sharing and incentive schemes will be assessed to provide lessons for REDD+. The NRF will be answerable to VPO.

In Tanzania, Technical Working Groups (TWGs) were established to provide technical inputs to the process of developing the National REDD+ Strategy. The TWGs are also a think tank toward development of the action plan. They will also ensure integration of

REDD+ issues in various sector ministries as well in Civil Society Organizations (CSOs) and private partners.

The National REDD+ Secretariat was established to facilitate activities of the NRTF and TWGs. It assists the NRTF in preparing the country for the REDD+ process as well as promoting a diversified set of activities aimed at testing mechanisms to improve the incentives for sustainable forest management. It also assists in developing capacities at all levels for the national processes for making Tanzania ready for the international markets for environmental services, in particular the carbon markets. A more permanent structure for the follow up and facilitation of REDD+ related activities will be put in place during the establishment of the permanent institution that will follow the NRTF.

Information sharing and networking

Information on the R-PP process and other aspects of REDD+ in Kenya is provided in the REDD+ webpage on the KFS website at <http://www.kenyaforestservice.org>. The webpage is an important resource for disseminating information to stakeholders and will be used for that purpose throughout the REDD preparedness period (Gichu, 2010).

National information about REDD+ in Tanzania can be accessed at the websites www.reddtz.org and www.nfp.org. These websites were established to share information with stakeholders at all levels about the REDD+ projects in Tanzania, upcoming events and REDD+ developments around the world. Information sharing is obviously important since it allows stakeholders to exchange lessons and experiences on REDD+.

REDD+ ACTIVITIES IN MANGROVES AT SUB-NATIONAL LEVEL IN KENYA

Electing Local Conservancy REDD+ Officers

In Kenya, a Local Conservancy REDD+ Officer was designated as focal point for REDD+ in each of the ten conservancies. These officers are part time staff initially, depending on the volume of work required, and they are responsible to the National REDD+ Coordinator. They liaise directly with operational staff members of the National REDD+ Coordination Office who in turn coordinate directly with REDD+ component task forces. They play a critical role in helping to implement demonstration activities for the REDD+ component task forces at pilot sites or locations at the local level as defined by the REDD+ Component Task Forces and NRCO. Conservancy Officers therefore coordinate with local committees, including civil society and other local community actors, who take part in the implementation of the activities and in evaluations. These staff would have forestry training, an understanding of forest policy and governance issues, knowledge of more technical issues related to carbon stock measurement and monitoring, as well as having good working

relationships with local authorities and civil society entities such as forest conservation committees and other bodies that may be involved in REDD+ early action testing. Local REDD+ conservancy officers will liaise with local representatives from agriculture, land, water, wildlife, community forest associations, CSOs, timber industry, and others as defined by REDD+ Component task force needs.

Electing REDD+ Component Task Forces (RCTF)

The RCTF are small groups that include members elected according to the subject matter of the REDD Strategy they will work on, and to the possible demonstration sites for that task force. These REDD+ Strategy task forces will include c. 12 members that together will have the expertise required for the design and oversight of each particular strategy. They receive quarter time honoraria. Each REDD+ task force elects a REDD+ Component Officer who is a full time staff that reports to the National Coordinator, and thus is member of the project implementation team.

REDD+ ACTIVITIES IN MANGROVES AT SUB-NATIONAL LEVEL IN TANZANIA

Regional level

In mainland Tanzania, the FBD has important roles in implementing, supervising and operationalizing REDD+ initiatives. This is based on already existing initiatives in the forestry sector, e.g. Participatory Forest Management (PFM), which includes Joint Forest Management (JFM), and Community Based Forest Management (CBFM). JFM involves co-management of forest reserves between government managers, which may be from either FBD or District Councils, and forest-adjacent villages, while in CBFM local villages, or sub-groups within them, are the sole forest managers based on the legal establishment of communally reserved forests on village lands (URT, 2007).

In Zanzibar, the Department of Commercial Crops, Fruits and Forestry (DCCFF) is responsible for the protection, conservation and development of forest resources for the social, economic and environmental benefits of present and future generations of the people of Zanzibar. As part of this responsibility the implementation, supervision and operationalizing of REDD+ activities are vested in DCCFF. The forest sector in Zanzibar encourages active involvement of local communities in the sustainable planning, management and conservation of forest resources through community forestry management agreements (CoFMAs). According to the Forest Resource Management and Conservation Act No. 10 of 1996 of Zanzibar, CoFMAs aim to provide local communities or groups with a means of acquiring clear and secure rights to plan, sustainably manage and benefit from local forest resources in order to help meet local needs, stimulate income generation and economic development, and enhance environmental stability.

Communities in the Rufiji Delta have the power to manage mangrove forests through JFM arrangements, while in Cheju and Pete villages such powers come through CoFMA. This indicates that the coordination of REDD+ activities at regional level adheres to the existing local government institutional structure. The JFM and CoFMA essentially provide the legal framework for community groups and governments to both own and manage forests for their own objectives/benefits.

District level

Local government is responsible for ensuring smooth implementation of REDD+ related activities in their areas of jurisdiction. The Regional Administrative Secretariat (RAS) serves as the link between the Ministries and the District Councils. At village level, village conservation committees serve as coordinators for REDD+ activities in their respective areas. In Zanzibar, REDD+ activities are coordinated by the Department of Forestry and Non-Renewable Natural Resources (DFNR) under the Ministry of Agriculture and Natural Resources. The DFNR serves as a link between Government and all REDD+ practitioners at National, District and *Shehia* levels. The Zanzibar First Vice President's Office (FVPO) which is coordinating all climate change matters through Department of Environment is also part of REDD+ development process.

REDD+ ACTIVITIES IN MANGROVES AT LOCAL LEVEL IN KENYA AND TANZANIA

Piloting mangrove REDD+ projects

Kenya and Tanzania are engaged in REDD+ and carbon credit activities in mangrove forests through pilot projects carried out by government and non-governmental organizations (NGOs), e.g. KMFRI, WWF and CARE International. The main objectives of these pilot projects are to protect and conserve mangrove forests using carbon finance and community based sustainable forestry management. This is important for harnessing the value of other mangrove ecosystem services, e.g. increased productivity of valuable commercial fisheries, within a payment for ecosystem services (PES) framework for poverty alleviation and livelihood improvements.

In Kenya, the *Mikoko Pamoja* ("mangroves together") was the carbon credit project piloted by the KMFRI for mangrove forest conservation and community livelihood improvements at Gazi Bay. This project was observed to be active in implementing its activities. The project aims to channel finance to the protection and restoration of mangrove ecosystems in Kenya through the provision of and payment for quantifiable ecosystem services. Specifically, the project aims to preserve the current quality and extent of the mangrove forests of Gazi Bay and the services they provide to local communities, i.e.:

- ▶ Restore degraded areas of mangrove forest;
- ▶ Raise income from forest resources, including carbon credits, for community benefit;
- ▶ Establish alternative sources of timber and firewood;
- ▶ Establish a pilot project demonstrating sustainable mangrove management that will influence mangrove management nationally in Kenya; and,
- ▶ Work with the KFS and other government agencies to determine policy about engaging communities in land management, particularly through the provision of ecosystem services through international carbon offset markets.

Mikoko Pamoja project activities include (Mikoko Pamoja, 2010):

- ▶ Delineation and mapping of protected areas and monitoring and evaluating their development;
- ▶ Reforestation of degraded areas and maintenance of nurseries;
- ▶ Determination of the carbon storage capacity of the Gazi mangroves using remote sensing, GIS technology and intensive ground-truthing;
- ▶ Planting of *Casuarina* plantations and other fast growing trees to substitute mangrove wood; and,
- ▶ Payments for ecosystem services.

In mainland Tanzania, WWF initiated REDD+ pilot projects in mangrove forest in the Rufiji Delta. However, during the time of this study, WWF was observed to be inactive in implementing its REDD+ activities in this area. Two major reasons were mentioned: a) the torching of farm huts and cutting down coconut trees by MMP Officials in October 2010, and b) the project was suspended due to financial problems. Corruption accusations were made against WWF Programmes in Tanzania, a situation that has interfered with timely implementation of WWF REDD+ pilot activities in mangrove forests in the Rufiji Delta.

On Zanzibar Island, CARE International is piloting REDD+ projects in mangrove forests known in Kiswahili as '*Hifadhi ya Misitu ya Asili*' ("conservation of natural forests", abbreviated HIMA). This project was observed to be active and is gaining momentum. The HIMA project aims to reduce greenhouse gas emissions from deforestation and degradation in Zanzibar, and generate carbon income which will provide direct and equitable incentives to communities to conserve forests sustainably. More specifically, the project aims to promote a pro-poor and gender-equitable approach to CBFM in Zanzibar, including piloting of carbon financing for REDD, which provides forest-dependent communities with secure property rights, equitable rewards for providing ecosystem services and other livelihood

benefits, and which informs the priorities of Zanzibar in the national REDD strategy. The HIMA project activities include expansion of CoFMAs, capacity building on REDD and climate change, effective measures to REDD, and monitoring, evaluation, documentation and advocacy.

CHAPTER 4 Potential and pre-conditions for increased implementation of national and sub-national REDD+ activities implemented in mangroves in Eastern and Southern Africa

POTENTIAL FOR INCREASED IMPLEMENTATION OF NATIONAL AND SUB-NATIONAL REDD+ ACTIVITIES IMPLEMENTED IN MANGROVE FORESTS

The theory underlying REDD+ projects implemented in mangrove forests is to make performance-based payments, that is, to pay mangrove forest owners and users to reduce emissions and increase sequestration of CO₂ (Lasco *et al.*, 2011). Such payments for environmental (or ecosystem) services is projected to provide strong incentives directly to mangrove forest owners and users to manage mangrove forests better and clear less of them (Wertz-Kanounnikoff and Kongphan-apirak, 2009). The evaluation of the potential of increased implementation of REDD+ activities in mangrove forests is important in the sense that it can help to show the degree of REDD+ success (Stern, 2008). In the context of this study, such an evaluation was based on the criteria developed by Stern (2008). These are: effectiveness, efficiency and equity, plus co-benefits and they are discussed in detail hereunder.

Effectiveness of REDD+ pilot projects in mangrove forest

A core idea behind REDD+ projects is to compensate participating communities in developing countries for keeping their forests intact to ensure that CO₂ held in the biomass is not released to the atmosphere and thereby contributing to global warming (Stern, 2008; Wertz-Kanounnikoff and Kongphan-apirak, 2009; Angelsen *et al.*, 2011; Lasco *et al.*, 2011). This means that the most important concern when assessing the effectiveness of REDD+ projects in mangrove forests is the extent to which they contribute to climate change mitigation. In this study attributes for assessing effectiveness of the pilot projects include information dissemination on the REDD+ concept, capacity building to implement REDD+ activities, provision of economic incentives and livelihood improvements. These attributes

were identified from proposed activities in the REDD+ pilot projects (CARE International, 2010; Mikoko Pamoja, 2010) and are elaborated on below:

Information dissemination on the REDD+ concept

In the context of this study, this aspect refers to the effectiveness with which information on the concept of REDD+ is being disseminated. 64.2% of respondents found that the performance of the pilot projects in conveying the message on the concept of REDD+ in mangrove forests was fairly good, while 35.8% ranked the performance as satisfactory. The study revealed that communities in the Gazi and Makongeni villages in Kenya were aware of the REDD+ concept in mangrove forests and of climate change. As many as 82.5% of the respondents in the Rufiji Delta and on Unguja Island were aware of the concept of the REDD+ and able to explain its meaning. Sources of information on the REDD+ concept were found to be village meetings, training workshops, study tours, church and mosque leaders, fliers, websites, journal articles, posters, television and radio. Thus, various sources of information were used by experts to introduce the concept of the REDD+ in the study areas.

In the Gazi and Makongeni villages, village assemblies, mosque and church leaders, chiefs, posters, women and youth group meetings, seminars, television, radio and workshops were important means used by KMFRI to introduce the REDD+ concept and its application in mangrove forests and relevance to livelihood improvements. Again, it was found that religious leaders and chiefs in the Gazi Bay were highly influential in mobilizing villagers for the *Mikoko Pamoja* project meetings and activities. This implies that in Kenya religious leaders and chiefs are also important people in disseminating information on the REDD+ concept to other community members. In their studies Cinner (2007) and Saunders *et al.* (2010) revealed that clan heads and chiefs were the main custodian of mangrove forest resources especially during the colonial era.

In the Rufiji Delta, meetings were the only media used by WWF to disseminate information on the REDD+ concept. In the Cheju and Pete villages, meetings, training workshops, study tours, fliers, television, radio and posters were important media used by CARE International to disseminate information. This suggests that increased information dissemination will raise awareness on REDD+ projects and encourage the local community to make deliberate attempts to manage mangrove forests sustainably since they appreciate their benefits.

Journal articles and posters showing activities addressing causes of loss of mangrove forests, demonstrating practical mechanisms for equitable benefit sharing, and explaining the potential of carbon finance to simultaneously reduce emissions and poverty were also used to show the general achievements made by CARE International and KMFRI in the HIMA and *Mikoko Pamoja* pilot projects. These achievements are available at websites www.careclimatechange.org/carbonfinance and www.eafpes.org for wider consumption.

This shows that there is growing interest in Kenya and Tanzania to disseminate information on the emerging carbon market in mangrove forests. However, there are generally poor information sharing and networking mechanisms on REDD+ issues in these countries. Lessons and experiences generated by different projects implementing REDD+ activities in the two countries are not easily available on the websites.

Capacity building to implement REDD+ pilot activities

Capacity building refers to transferring knowledge to individuals or groups to enable them to increase participation in REDD+ pilot activities. The PRA results revealed that KMFRI was fairly effective in enhancing capacity of communities residing at Gazi Bay to implement *Mikoko Pamoja* project activities. People in the Gazi and Makongeni villages were found to be knowledgeable on the carbon sequestration potential of mangrove forests with the emerging voluntary carbon markets. People in these two villages indicated that they have received knowledge from KMFRI on carbon trade, carbon stock assessment, mangrove forest protection, tree planting and monitoring, integrated aquaculture and seaweed farming, PES and community development, natural resources management, and preparation of contracts. This means that the scientific knowledge and expertise that exist at KMFRI on mangrove forests and REDD+ are now put into practice. This is important for the sustainable management of mangrove forests and enhancing carbon sinks.

CARE International was fairly effective in enhancing capacity of local communities to implement HIMA pilot project activities in mangrove forests in Cheju and Pete villages (Figure 4). Village Conservation Committees in these villages were found to have confidence and skills to articulate their interests and concerns on project activities in mangrove forests close to their area. These committees mentioned that they have received training and exposure visits on REDD+ and climate change issues from CARE International and Jozani Environmental Conservation Association (JECA). They learnt several aspects of technical management, such as carbon stock assessment, preparation of operational plans and various forest management activities. However, communities in Cheju and Pete villages were complaining that the time taken by CARE International and JECA to train VCCs on REDD+ and climate change in mangrove forests was too short for them to capture properly all information necessary for implementing HIMA project activities.

WWF was observed to be rather ineffective in enhancing capacity of local communities to implement REDD+ activities in mangrove forest in the Rufiji Delta (Figure 4). This was due to the fact that training and seminars related to carbon stock assessment were not offered by WWF to VNRCs since they had not yet started the process of capacity building in the area. This resulted in people in the Rufiji Delta having a weak capacity to implement REDD+ activities in mangrove forests. According to WWF-EARPO (2006), capacity building is a useful approach as it facilitates transforming communities by raising awareness on sustainable management of mangrove resources and GHG emission reductions. Again,

capacity building, especially the involvement of local people, ensures sustained mangrove forest conservation even after the end of the project (CARE, 2010).

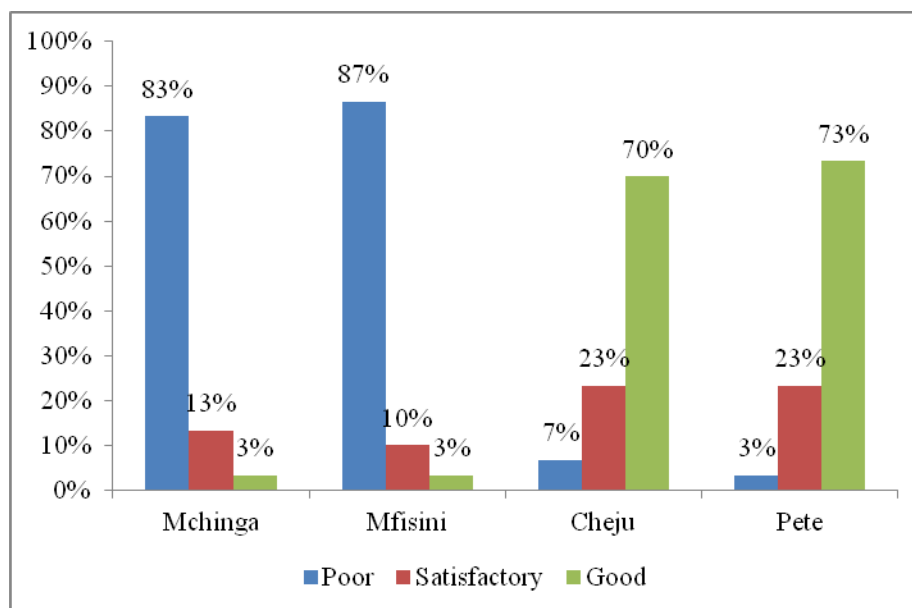


Figure 4. Respondents' perceptions on REDD+ pilot projects to enhance capacity in mangrove forest protection and conservation in Tanzania.

Provision of economic incentives

Economic incentive refers to motivation given in the form of monetary rewards to communities for increasing protection and conservation of mangrove forests. Disbursement of carbon funds to the villagers acted as an indicator of economic incentives in this case. During the time of this study, the *Mikoko Pamoja* and HIMA projects were found to be in the development stage, meaning that they had not yet started disbursing carbon funds to communities. In the meantime, they are expected to provide new sources of revenues to be used as economic incentives to increase protection and conservation of mangrove forests in Kenya and Tanzania. This means that the potential of carbon sequestration using additional financial resources through the REDD+ carbon financing mechanism to mangrove dependent communities have not yet been realized in Kenya and Tanzania.

Communities at Gazi Bay were observed to have high expectations from the *Mikoko Pamoja* project with regard to disbursement of carbon funds as economic incentives to motivate them to protect and conserve mangrove forest (Table 1). Key informants interviews revealed that the *Mikoko Pamoja* project is expected to generate about US\$ 15 000 per year to the community from sale of 3 000 tCO₂ equivalent into the Voluntary Carbon Market. The money raised through the project will be channelled to finance protection and restoration of mangrove ecosystem and support community development.

The expectations of communities in Cheju and Pete villages on the HIMA project to provide cash as economic incentives to motivate them to protect and conserve mangrove forests was high (Table 1). Discussions held with CARE International officials revealed that this project is aiming at reducing GHG emissions from deforestation and degradation in Zanzibar while at the same time providing economic incentives to communities to conserve mangrove forests sustainably. Equally important, the HIMA project is designed to provide community forest management (CoFM), a shift away from only conservation, to a benefit oriented approach by making carbon credit viable. This is expected to provide communities with incentives for more sustainable mangrove forest use. On the other hand, communities in Mchinga and Mfisini villages were observed to have no expectations on WWF REDD+ pilot project to motivate them to protect and conserve mangrove forests (Table 1). This was due to the fact that WWF had been inactive in implementing REDD+ activities in the Rufiji Delta.

Table 1. Expectations of communities from REDD+ projects in providing economic incentives in Kenya and Tanzania

Country	Area	Village name	Expectations on economic incentive from REDD+ projects
Kenya	Gazi Bay	Gazi	High
		Makongeni	High
Tanzania	Unguja Island	Cheju	High
		Pete	High
	Rufiji Delta	Mchinga	No expectations
		Mfisini	No expectations

Livelihood improvements

Livelihoods refer to the ways in which people generate the necessary and desired food and financial resources to live an optimal life. Over the years, mangrove forests of Kenya and Tanzania have been subjected to an ever increasing human population and to economic pressure due to lack of formal employment opportunities (Kairo *et al.*, 2002; Silima *et al.*, 2009; Kitula, 2012). This suggests that where there is lack of formal employment, deforestation and degradation of mangrove forests is greater (Kitula, 2012), a situation that

is contributing to increased GHG emissions to the atmosphere (Donato *et al.*, 2011). The REDD+ pilot projects in mangrove forests were initiated to channel finances for expansion of community funds to support existing or initiating new community projects to improve livelihoods and relieve pressure on mangrove forests. The *Mikoko Pamoja* and HIMA projects are still in their development stages but are expected to strengthen communities and provide employment for villagers. For example, *Mikoko Pamoja* is already accredited to sell 3 000 tCO₂ equivalent annually to Plan Vivo. Benefits accrued from sale of mangrove carbon will be invested in local projects determined by communities themselves. In this way the project will contribute to livelihood improvements at Gazi Bay.

Table 2. Expectations of communities from REDD+ projects in supporting livelihood improvements in Kenya and Tanzania

Country	Area	Village name	Expectations of communities on livelihood improvements from projects
Kenya	Gazi Bay	Gazi	High
		Makongeni	High
Tanzania	Unguja Island	Cheju	High
		Pete	High
	Rufiji Delta	Mchinga	No expectations
		Mfisini	No expectations

Communities at Mchinga and Mfisini villages were found to have no expectations on the WWF REDD+ pilot project with regard to livelihood improvements (Table 2). A likely explanation for this was that the opportunity costs from WWF to make sustainable management of mangrove resources compete with harvesting of poles and conversion of mangrove forests to rice and salt farms were lacking. None of the study villages in the Rufiji Delta had been promised by the WWF to be paid opportunity costs to limit their dependence on mangrove resources for livelihood improvements. This means that if alternative income sources are not provided the mangrove forests will continue to be deforested and degraded, thereby contributing to increased emissions of GHG to the atmosphere.

Efficiency level of REDD+ projects

Efficiency denotes the minimum costs incurred to successfully implement REDD+ pilot projects. The efficiency of REDD+ projects was approached by assessing whether lower transaction costs show a better project performance (North, 1990). Communities were asked to evaluate the level of efficiency of the REDD+ pilot projects in mangrove forests close to their areas. Attributes for efficiency include: i) supplementing government efforts to protect and conserve mangrove forests; ii) making use of existing institutional arrangements to implement REDD+ pilot activities; iii) involving district officials to initiate REDD+ pilot activities; and iv) involving communities in decision making.

Supplementing government efforts to protect and conserve mangrove forests

Communities' perceptions on REDD+ projects to support the governments of Kenya and Tanzania in the protection and conservation of mangrove forests are shown in Table 3.

Table 3. Perceptions of communities on REDD+ projects in supporting governments of Kenya and Tanzania in mangroves conservation

Country	Area	Village name	Level of efficiency of projects to support governments in mangrove conservation
Kenya	Gazi Bay	Gazi	Efficient
		Makongeni	Efficient
Tanzania	Unguja Island	Cheju	Efficient
		Pete	Efficient
	Rufiji Delta	Mchinga	Efficient
		Mfisini	Efficient

The table shows that the idea behind the REDD+ pilot projects was considered rather efficient with respect to supplementing efforts of the governments of Kenya and Tanzania in the protection and conservation of mangrove forests. The projects were initiated as climate change mitigation measures and to generate new financial resources for the protection and conservation of mangrove forests (Angelsen, 2008). As such, the projects are important in contributing to relieving expenditures by governments in developing countries in the protection and conservation of mangrove forests. The study showed that before the

introduction of the REDD+ policy, the governments of Kenya and Tanzania had already put in place policies and measures to protect remaining forest resources and to improve local livelihoods and biodiversity. The Kenya Forest Service and KMFRI in Kenya, as well as MMP in the Rufiji Delta and the Department of Forest in Unguja Island, had a range of duties associated with protection and conservation of mangrove forests. Some of these duties include planting of mangroves, law enforcement, capacity building, livelihood improvement and forest protection. Therefore, the implementation of the REDD+ pilot projects contributes to meeting the governments' efforts to protect and conserve mangrove forests and to reduce poverty.

Making use of existing institutional arrangements to implement REDD+ activities

The REDD+ pilot projects in mangrove forests were fairly efficient in making use of existing institutional arrangements to implement their activities (Table 4). It was found that the existing Community Forest Association (CFA), known as Gogoni Gazi CFA in the Gazi area, was used by KMFRI as an entry point to register Mikoko Pamoja Community Organisation (MPCO) in order to implement the *Mikoko Pamoja* project. A CFA is a legal way of acquiring carbon rights after having been granted a "Forest agreement" as stated in the Kenya Forest Act 2005. Likewise, the existing VNRCs in the Rufiji Delta and VCCs in Unguja Island were used as entry points by WWF and CARE International to implement REDD+ activities in Tanzania. VNRCs had been initiated in the Rufiji Delta since the late 1990s. In the Unguja Island, VCCs also started in the late 1990s. This shows that REDD+ activities in mangrove forests are implemented within the existing network of community organisations engaged in PFM. A likely explanation for this was that the REDD+ projects are designed to create economic incentives at grassroot level. Again, PFM provided the foundation for implementing REDD+ interventions within the existing institutional frameworks, which is simple and cheap in terms of monitoring, enforcements and other costs. North (1990) pointed out that in order to achieve lower transaction costs in the management of natural resources it is essential that new projects like the REDD+ mangrove projects build on already existing initiatives.

Table 4. Perceptions of communities on REDD+ projects on using existing institutional arrangements in Kenya and Tanzania

Country	Area	Village name	Level of efficiency of projects in using existing institutional arrangements in mangrove conservation
Kenya	Gazi Bay	Gazi	Efficient
		Makongeni	Efficient
Tanzania	Unguja Island	Cheju	Efficient
		Pete	Efficient
	Rufiji Delta	Mchinga	Efficient
		Mfisini	Efficient

Involving district officials to initiate REDD+ pilot project activities

The degree to which district officials were involved in initiating REDD+ activities in mangroves was used as a parameter to assess the efficiency level of mangrove REDD+ projects. The Mikoko Pamoja project was fairly efficient in this respect in the Gazi and Makongeni villages (Table 5) because of the involvement of KMFRI and KFS officers in initiating the project. Involving government officials tend to ensure sustainability of mangrove conservation when the project is phased out (CARE, 2010).

Communities in the Mchinga, Mfisini, Cheju and Pete villages found REDD+ projects inefficient in involving district officials to initiate activities. In the Mchinga and Mfisini villages, experts from WWF were the ones that introduced the concept of REDD+ and climate change issues in mangrove forests. In the Cheju and Pete villages, REDD+ projects were introduced by CARE International Officials. District officials, including the MMP in the Rufiji delta and Forest Officers in Unguja Island, were involved during field activities. In other words, REDD+ projects in Tanzania are not state owned projects as they are making use of NGO staff to pilot their activities.

Table 5. Perceptions of communities on REDD+ projects in involving district officials in REDD+ activities in Kenya and Tanzania

Country	Area	Village name	Level of efficiency of projects in involving district officials in activities
Kenya	Gazi Bay	Gazi	Efficient
		Makongeni	Efficient
Tanzania	Unguja Island	Cheju	Inefficient
		Pete	Inefficient
	Rufiji Delta	Mchinga	Inefficient
		Mfisini	Inefficient

Involving communities on decision making

The study showed that KMFRI was fairly efficient in involving communities in the Gazi and Makongeni villages in decisions to implement the *Mikoko Pamoja* project (Figure 5). CARE International was also fairly efficient in involving communities on the Unguja Island in decision making to implement the HIMA project. The majority of respondents in Cheju (73%) and Pete (70%) villages indicated that they attended village assemblies to discuss and approve the implementation of the HIMA project close to their villages. High involvement of households in decision making on conservation activities is likely to increase the performance of the *Mikoko Pamoja* and HIMA projects to protect and conserve mangrove forests. In most cases, participation in decision making generates a commitment among individuals to make their society work and increases their willingness to make necessary compromises (Kitula, 2012).

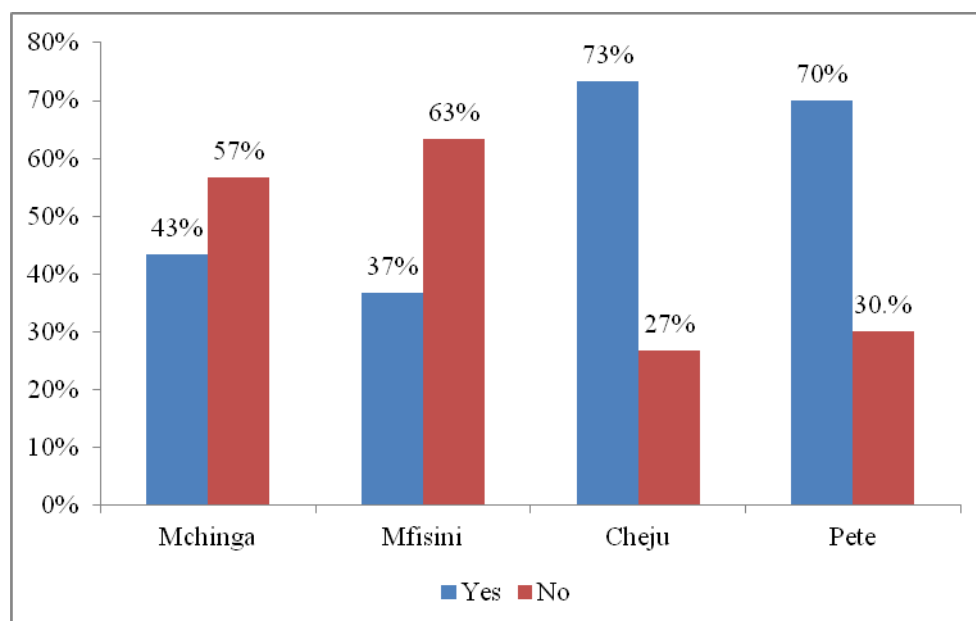


Figure 5. Community involvement to enter REDD+ projects in Kenya and Tanzania

In the Rufiji Delta, WWF performed inefficient in involving communities in decision making to enter into REDD+ pilot project. Less than half of the respondents in the Mchinga (37%) and Mfisini (43%) villages mentioned that they were involved in such decision making, which was due to the fact that the project commenced in the peak season of crop season. This means that the opinions of the majority of villagers were not considered, a situation that was observed to reduce the commitment of individuals towards achieving project goals.

Level of equity of REDD+ pilot projects

Equity refers to the fair distribution of costs and benefits in the implementation of mangrove REDD+ projects. Communities were asked to evaluate the level of equity of the projects. Attributes of equity include: i) sustainable harvesting of mangrove resources; ii) equitable benefit sharing; iii) all groups benefit from projects; and, iv) presence of agreements to implement REDD+ activities.

Sustainable harvesting of mangrove resources

When REDD+ projects were first introduced in mangrove forests in the study areas, communities thought it as a matter of strict protection of the forests to reduce GHG emissions. However, this perception is contrary to the objective of the REDD+ policy, which allows sustainable harvesting of mangroves. This includes harvesting of allowable cut within a given area. The study showed that commercial logging continued in some stands of mangrove forests at Gazi Bay through a system of permits issued by the KFS. Communities in the Rufiji Delta are allowed to harvest mangrove poles both for subsistence and

commercial purposes through permits from VNRC and MMP Officers. In the Unguja Island commercial harvesting of mangrove poles is illegal but communities are allowed to sustainably harvest mangrove poles for subsistence use after obtaining a permit from VCCs. Fishing, beekeeping, crab collection, small-scale salt making and eco-tourism are allowed in the mangrove forests in both Kenya and Tanzania. The permit systems imposed by governments to keep track of the number of dealers of mangrove poles and to ensure sustainable harvesting of mangrove resources are thus also applied in the REDD+ framework.

Despite the presence of permit systems, illegal activities in the mangrove forests of the study areas are escalating. This situation affects a wide range of socio-economic and environmental characteristics of mangrove forests (Shaghude *et al.*, 2004; Benfield *et al.*, 2005; Lovelock *et al.*, 2005; Murray *et al.*, 2005; Wagner, 2008). For example, forest degradation through poaching and cutting for firewood has resulted in shortages of building poles and firewood, decreased fishery resources and increased coastal erosion at Gazi Bay (Mikoko Pamoja, 2010). Nearly 33% of respondents in the Rufiji Delta and Unguja Island indicated that they are harvesting mangrove poles illegally due to high costs associated with permits and transport. This shows that monitoring of compliance of rules by community members is poorly enforced and this situation is contributing to increased deforestation and degradation of mangrove forest in the study areas.

Equitable benefit sharing

One of the objectives of the REDD+ projects is to provide equitable benefit sharing as incentives to motivate participating communities to reduce deforestation and degradation of mangrove forests (FORCONSULT, 2010). The study showed that the *Mikoko Pamoja* project has taken this issue into consideration. For example, more than half (62%) of the mangrove carbon credit is allocated to support the annual running costs of the project, including paying the salary of the Project Coordinator and recruitment of local labourers. A very small portion (5%) of the carbon credit is budgeted to run office expenses. The remaining portion (33%) is allocated for spending on community projects as determined through an annual prioritization process. This means that modalities for distributing benefits resulting from mangrove forest protection and conservation are clear to local communities in Kenya.

Communities in the Rufiji Delta were asked to express their feelings regarding the issue of equitable benefit sharing in the WWF REDD+ pilot project. Communities in the Mchinga and Mfisini villages were not convinced that there would be equitable sharing of benefit from the carbon credits. It was claimed by the Rufiji Delta communities that when JFM was introduced by MMP in the area over two decades ago, one of the promises made was that there would be equitable benefit sharing of revenues accrued from sustainable management of mangrove resources. However, MMP failed to meet this promise and

therefore the WWF REDD+ project was seen by the villagers as part of the MMP promise since WWF and MMP work in partnership on mangrove restoration in the area. Consequently, communities are uncertain on how the fund accrued from the carbon savings will be disbursed to them.

Despite the fact that communities in the Cheju and Pete villages were observed to be serious about the HIMA project, they are worried about present uncertainties regarding mechanisms of carbon markets and benefit sharing due to increased insecurity of forest ownership as all mangrove forests are gazetted forest reserve. In other words, mangrove forests are owned by the central government and they are managed through the Department of Commercial Crops, Fruits and Forestry (DCCFF) as a National Park (the Jozani-Chwaka Bay NP). Villagers have been given power to manage mangrove forests through VCCs. Until now, modalities for distribution of benefits resulting from mangrove forest carbon fund and transactions are not clear to local communities in Tanzania.

All groups benefit from REDD+ projects

The study showed that the established CFAs in Gazi Bay, VNRCs in the Rufiji Delta and VCCs on the Unguja Island are used as entry points to implement mangrove REDD+ pilot project activities. These committees are made up of people of different economic status and age categories. The committees also consider gender aspects in that both men and women have equal opportunities to attend seminars, study tours and training on climate change and REDD+ issues. In Gazi Bay, financial rewards for avoiding deforestation will contribute to common pool resources (CPRs) owned by the community, such as an improved school building, and investment in village infrastructure such as electrification and improved sanitation. In Cheju village, mechanisms were developed to ensure fair distribution of the REDD+ project fund. In order to guarantee this, communities were categorized into four groups: women, old people, disabled people and other community members. Processes were underway in Pete village to develop modalities for equal distribution of REDD+ project funds to benefit all groups in the communities with incentives for more sustainable forest use. This strategy is likely to build a sense of ownership of the projects and therefore providing support in preventing emissions of GHGs in mangrove forests.

Ensuring agreement to implement REDD+ activities is prepared

Presence of agreements to govern participation in the implementation of REDD+ activities was used to evaluate the level of equity of the projects. Theories governing “the commons” explain that in order to be sustainable a resource use system must have rules about who has access to the CPRs (Ostrom, 1990). All respondents in the Rufiji Delta were complaining about the absence of an agreement on their participation in the REDD+ activities. In Gazi Bay, a constitution was developed by the Mikoko Pamoja Organization to guide the protection and conservation of mangrove forests in order to generate carbon

income for livelihood improvements. In Cheju and Pete villages, the existing Community Forest Management Agreements (CoFMAs) were updated and adjusted to suit the REDD+ programme. For example, the length of the agreements was extended from 5 to 20 years so as to secure the ownership into the future, and hence is intended to support the “permanence principle” in REDD+ to ensure longevity of carbon pools. Equally important is that almost everyone in Gazi Bay and Unguja Island were aware of these agreements and considered them as clear to understand, flexible to the needs of the people, fair and legitimate. This is likely to reduce involvement in illegal activities in the mangroves and hence improve the forest conservation status. This in turn may increase the performance of the *Mikoko Pamoja* and HIMA projects. As reported by Ostrom (1990), Gbate and Nagendra (2005) and Saunders *et al.* (2010), successful institutions depend on the presence of rules for access to and maintenance of a CPR.

Co-benefits

The evaluation of co-benefits of mangrove REDD+ projects was based on four dimensions: i) forest conservation, ii) political change, iii) socio-economic benefits, and, iv) adaptation to climate change (Stern, 2008). These dimensions are discussed in detail hereunder.

Forest conservation

Forest conservation involves careful use of mangrove forest resources so that they last as long as possible and benefit as many as possible. In the context of this study, attributes of forest conservation include: tree planting, tree retention on farms, use of fuel efficient cooking stoves, and access to financial assistance.

Mangrove tree planting

In the study areas participation in mangrove tree planting was voluntary. The majority (85%) of respondents mentioned that they have participated in tree planting activities. Communities in Gazi Bay were involved in growing mangroves in the deforested intertidal areas of the bay since 1991. The current plan of the Gazi community is to expand mangrove reforestation activities by replanting more than 10 ha of eroding shoreline of the bay with suitable species (Plate 1A). Again, the Mikoko Pamoja project planned to expand reforestation efforts in mangrove forests by replanting one hectare annually. In the Rufiji Delta, MMP and VNRCs were involved in rehabilitating degraded areas in mangrove forests since 1995. WWF and the Marine and Coastal Environmental Management Project (MACEMP) facilitated MMP and VNRCs in planting mangrove trees for climate change mitigation.

Plate 1B shows three year old mangroves planted by MMP, in collaboration with local communities and with support from WWF, to mitigate climate change. From 1995 to 2011, 1426.5 ha of mangrove forests were planted in the Rufiji Delta. Since the 1990s, many

villages on the Unguja Island have undertaken mangrove planting programmes on open and degraded areas. Nearly 40 ha of such land are being planted annually. Reforestation with mangrove trees contributes to environmental protection and to carbon sequestration. However, the sad reality is that planting of degraded areas does not match the deforestation rate of mangroves areas (Silima et al., 2009).



Plate 1. Planted mangroves at eroding shoreline of the Gazi Bay in Kenya (A) and planted mangroves for climate change mitigation in the Rufiji Delta (B) (Photo R. Kitula, 2012)

Tree retention

The study showed that various tree species were retained when farmers clear land for crop farming. On average, each respondent retained four trees on his/her farm. All mangrove species in Gazi Bay and Unguja Island grow in areas that cannot be used for agriculture. Respondents in the Rufiji Delta who had farms in the mangrove forest mentioned that they have retained trees on their farms (Plate 2A) in order to ensure expansion and regeneration of mangrove resources. Respondents in Cheju and Pete villages mentioned mangos, coconuts, citrus, damson, bananas and pine trees to be left in the farm when they clear land for crop production (Plate 2B). The reasons for retaining these tree species included provision of shade, food and fruits, and fuel wood, to demarcate farms and to burn charcoal for sale. Thus, the retention of trees on farm has a potential for mangrove REDD+ projects since it provides both socio-economic and ecological benefits.



Plate 2. Retained mangrove trees on farm when land is cleared in Rufiji Delta, Tanzania (left); Some trees left on farm when land is cleared in Cheju village, Tanzania (right) (Photo R. Kitula, 2012)

Use of fuel efficient cooking stoves

Interviews showed that the HIMA project is expected to implement an energy switch from charcoal and firewood to Liquid Petroleum Gas (LPG), especially in urban and peri-urban areas, and will promote the use of fuel efficient stoves in rural areas. At the time of this study, none of respondents had, however, indicated that they used efficient cooking stoves. This means that open fire places were the most common traditional technology used by people in the study areas. The disadvantage of this is that it increases the amount of wood consumed. Firewood was the main source of energy in the study villages. Mangrove trees were important sources of firewood for the Gazi and Makongeni villages. In the Mchinga and Mfisini villages, firewood was collected from mangrove forests for home consumption only. In Pete village, mangrove trees were cut to provide firewood for villagers and town dwellers on Unguja Island. All this indicates that the pressure on mangrove forests for firewood is high, a situation that has led to a shortage of those mangrove species preferred for firewood in the study areas. It also contributes to an increased emission of GHGs to the atmosphere. In Kenya, more than 70% of the national energy demand is derived from firewood (Gichu, 2010) and in Tanzania more than 80% of people use firewood as the main source of energy (Luoga *et al.*, 2000).



Plate 3. Salt making in mangrove forest in the Rufiji Delta, Tanzania (left); Beekeeping in mangrove forest in Mfisini village, Tanzania (right) (Photo R. Kitula, 2012)

Raise community fund

The majority (75%) of respondents believed that the REDD+ pilot projects will raise community funds through carbon credits which in turn will be used to initiate new or expand existing community projects for livelihood improvement. The study further showed that communities in the study area have initiated saving and credit societies (SACOS) to facilitate the provision of economic services for improving living standards. In this system, transaction costs were reported to be lower and no down payment is required for taking a loan. Hence, it provides a better opportunity for promoting rural financial services. Nearly 32% of respondents indicated that they have received loans from SACOS and that they invested these in fishing, fish farming, salt making (Plate 3A), beekeeping (Plate 3B), and poultry. Raising community or individual funds is believed to reduce poverty and increase protection and conservation of mangrove forests (King, 2012; Blomley and Tennigkeit, 2012). This in turn is likely to increase the quality of mangrove forests and enhance their roles as carbon sinks. Studies by Donato *et al.* (2011) and Kauffman and Donato (2012) stressed the importance of protecting and conserving mangrove forests for enhancing carbon capture both in woody biomass and sediment.

Political changes

Political change refers to the ability of REDD+ projects to reduce corruption in mangrove forest management. In this study, attributes of political change include: i) accountability in forest protection, ii) transparency, iii) rule of law, and, iv) consensus oriented. These are discussed in detail below.

Accountability in forest protection

All respondents indicated that they have high expectations on the ability of REDD+ pilot projects to increase accountability of CFA in the Gazi Bay, VNRCs in the Rufiji Delta and VCCs on Unguja Island to protect mangrove forests from illegal activities. Until recently, these committees had low accountability in this respect. For example, patrols to curb illegal activities are not organized as intended due to lack of equipment and financial incentives. Normally, self-organized patrols need to be done twice a week since mangrove forests in the Gazi Bay are cut illegally for timber and firewood. Nearly 33% of respondents were involved in the illegal harvesting of poles for commercial purposes in the Rufiji Delta and Unguja Island. All respondents (100%) in the Mchinga and Mfisini villages admitted that they have encroached mangrove forests for rice farming (Plate 2A). The reasons given for this were that mangrove soils are fertile and have a high capacity to retain moisture, and that capital investment needs are low. Poor accountability of officials entrusted with mangrove protection resulted in increased incidences of illegal activities, e.g. random forest clearing by farmers, which contributes to releasing carbon stored in mangroves (Wagner, 2008).

Transparency

Establishment of fair and transparent payment mechanisms for carbon funds is important as incentives to stakeholders. Such mechanisms will enable the state to account for gains and losses and to reward stakeholders who are responsible for reductions in carbon losses in a fair way (FORCONSULT, 2010). Respondents in Gazi Bay indicated that there is a high level of transparency regarding carbon funds in the Mikoko Pamoja project. A likely explanation for this was that communities in the area are aware of the amount of carbon money that will be generated annually from conservation of 117 ha mangrove forest. The majority (78%) of respondents in Tanzania indicated that the level of transparency of the WWF and CARE International in handling the carbon fund was rather poor. Communities in the Rufiji Delta and Unguja Island were complaining that information on the carbon funds is not freely available and directly accessible to them. Modalities for distributing carbon funds were unknown in Tanzania. Interviews with key informants showed that there were unclear directives on who should disburse carbon funds to local communities. For example, both the Forest Department and CARE International on Unguja Island claimed to be the rightful distributor of such funds to villagers.

Rule of law

Rule of law includes the presence and enforcement of impartial legal frameworks concerning mangrove forests. Any person found cutting and transporting mangrove poles without a permit and a license has to be penalised. Disciplinary measures for those who violate the rules are either fines, confiscation of poles/logs and working gears, or sent to court of law, or both (URT, 2002). All respondents indicated that they have high expectations from the REDD+ pilot projects in increasing the enforcement of fair legal frameworks in mangrove forests. Meanwhile, the MMP and VNRCs in the Rufiji Delta, as

well as Forest Officers and VCCs on Unguja Island, performed rather poorly in the area of applying the rule of law. In many cases, MMP in the Rufiji Delta and Forest Officers on the Unguja Island collaborated with illegal harvesters of mangrove poles since they received bribes from them. Again, very few cases associated with rule violations lead to punishments. Village Natural Resources Committees (VNRCs) and VCCs are reluctant of reporting illegal activities committed by their family members and friends.

Consensus oriented

Interviews with key informants showed that the planning process for formulating the *Mikoko Pamoja* and HIMA project proposals was participatory and inclusive. The proposal for the former project was formulated by a team comprising Earthwatch International, KMFRI and the Gazi community (as represented by the Gazi/Earthwatch committee) and the development of the HIMA proposal involved meetings with key stakeholders, viz. DCCFF, DoE, and other relevant government institutions and NGOs/CBOs based in Zanzibar. The process concluded by working out and finalizing the project goal, objectives, outputs, activities and timeframe. Concurrently, more meetings were held between CARE International and DCCFF to discuss key points and partnerships which indicates that the decision to implement REDD+ pilot activities in mangrove forests were received and approved in a consensus manner. This should facilitate smooth implementation of the activities.

At local level, the decisions to implement the REDD+ projects were introduced and discussed in village meetings. These were primarily convened between KMFRI, KFS, WWF, CARE International, Trainer of Trainers (ToTs) and village conservation committees to introduce the decisions, which were then communicated to villagers by village conservation committees during village assemblies. This means that the village assemblies are very important since they discuss the REDD+ projects before they are approved for actual implementation. The *Mikoko Pamoja* project was accepted in Gazi Bay and communities in the Mchinga and Mfisini villages indicated willingness to implement the WWF REDD+ pilot project in the adjacent mangrove ecosystem. Likewise, the HIMA project was accepted in the Cheju and Pete villages.

Socio-economic benefits

Attributes of socio-economic benefits of REDD+ pilot projects in mangrove forests include: i) strengthening social cohesion, ii) improving infrastructure, iii) protecting cultural values of mangrove forests, and iv) creating job opportunities.

Strengthening social cohesion

Social cohesion refers to a situation in which local communities demonstrate an ability to collaborate that produces a climate for change that, in the longer run, benefits all.

Communities in the study areas were interested in participating in collective actions in managing mangrove forests, including collective tree planting in degraded mangrove areas. In the Rufiji Delta, illegal activities were collectively reported to the MMP, while on Unguja Island illegal activities were reported to Forest Officers. People also showed willingness to contribute free labour to REDD+ activities. According to Kairo (1995), Boateng (2006) and Kitula (2012), participation in forest management initiatives increases awareness about the value of collective action on forest resource management.

Improving infrastructures

Infrastructure includes physical and organizational structures (e.g. roads, buildings) needed for the operation of the REDD+ pilot projects. It was observed that the study villages were easily accessible by roads and boats, which means that access of transport is not hindering the potential for increased implementation of REDD+ pilot activities in the study areas. With reference to availability of working space, the Cheju village was assisted by TASAF to construct a village government office (Plate 4). In Gazi Bay, the desk work for the *Mikoko Pamoja* project activities is done in KMFRI's building. This means that space is readily available for the mangrove conservation committees to work efficiently. Again, schools have been built in all villages surveyed, often in collaboration between the state and donor agents. Nearly 80% of the respondents had a primary level of education. Promoting formal education and improving its quality (Sumra and Rajani, 2006) increases the efficiency of implementing REDD+ activities. In their study, Kajembe and Luoga (1996) argued that promoting formal education creates awareness and positive attitudes of communities towards sustainable use and management of natural resources.



Plate 4. Village government office at Cheju village, Tanzania (Photo R. Kitula, 2012)

Protecting cultural values of communities towards mangrove forests

Cultural values refer to beliefs that have both economic and noneconomic implications. In the study areas people have high expectations on the REDD+ pilot projects to protect the cultural values of the mangrove forests. Communities have a long history of using mangroves both for commercial and subsistence reasons, and they have also identified and reserved sacred sites within forests for performing traditional rituals and harvest medicinal plants. Damage or destruction of such sacred sites means that ancestors might become homeless and that cultural values might suffer. Therefore, normal human activities are not allowed in these areas. They are respected by all and this contributes to the conservation of mangrove forests. Since the REDD+ pilot projects are designed to increase protection and conservation of mangrove forests it is likely that such “cultural reserves” will enhance the objectives of the REDD+ projects and strengthen the sustainability of these forests.

Creating job opportunities

Communities’ expectations on REDD+ pilot projects to create job opportunities was not significantly different across the study villages. Most (72%) respondents indicated that they have high such expectations. The *Mikoko Pamoja* project has employed one local person full time (as a project administrator) and about seven people part time as assistants helping with nursery establishment (Plate 5), tree planting and project policing. In Pete village, the income from the REDD+ project is planned to be used to initiate new and expand existing eco-tourism activities. In the Cheju village, opportunities to initiate eco-tourism in mangrove forest through REDD+ funds are high. It certainly appears as if increased eco-tourism has a

great potential to create local job opportunities, and thus reduce pressure on the mangrove forest and increase carbon sequestration.



Plate 5. Mangrove nursery established at Gazi Bay, Kenya (Photo R. Kitula, 2012)

Adaptation to climate change

Adaptation to climate change refers to adjustments in ecological, social and economic systems to counter the effects of climate change. In the context of this study, attributes of such adaptation include: i) management of coastal erosion, ii) drought management, iii) flood management, and iv) advocating the application of fertilizers and pesticides.

Management of coastal erosion and sea level rise

The majority (70%) of respondents indicated that they have high expectations on the REDD+ pilot projects in strengthening their efforts to address the impacts of coastal erosion and sea level rise. Communities expect to get financial assistance from the REDD+ projects to increase tree planting to protect the coastline and enhance mangrove carbon stock. There is a growing problem of coastal erosion in the study areas (Plates 6A and 6B) and efforts to protect mangrove forests from its impact have been initiated. In Gazi Bay, KMFRI initiated steps already in 1991 to reforest degraded mangrove areas with suitable species. By 2007, more than 1 million trees had been planted. Survival rates range from less than 10% in more exposed areas to more than 70% in newly harvested protected areas (Kairo *et al.*, 2001). In the Rufiji Delta, the climate change adaptation project to mitigate effects of sea level rise and coastal erosion was initiated by WWF and implemented by MMP in collaboration with VNRCs and farmers. Nearly 206 ha of degraded mangrove forests were planted in 2011. On Unguja Island, many villages have undertaken planting programmes in open and degraded areas since the 1990s to mitigate impacts of sea level rise and coastal

erosion. Although mangrove planting initiatives are ongoing, the continued pressure on these forests by illegal activities (Plate 7) offsets those efforts and the net effect is still an increased deforestation and degradation. As an example, communities in the Rufiji Delta are destroying mangroves as they search for new land to grow their rice crops, which are being damaged by salt-water intrusion due to sea level rise (Plate 2A).



Plate 6. Beach erosion at Rufiji Delta, Tanzania (left), and Gazi Bay, Kenya (right) (Photo R. Kitula, 2012)



Plate 7. Illegal cutting of mangroves in Cheju village, Tanzania (Photo R. Kitula, 2012)

Management of prolonged droughts

Prolonged droughts tend to result in decreased mangrove productivity, growth, and seedling survival, and in changed species composition favouring more salt tolerant species.

Prolonged droughts are also likely to result in a decrease in mangrove area and diversity, and in projected loss of the landward zone to unvegetated hyper saline flats (McLeod and Salm, 2006; Wagner, 2008). Change in climate has resulted in more prolonged droughts (McLeod and Salm, 2006). Scarcity and unreliability of rainfall were found to threaten crop production in the study areas. The majority (87%) of respondents perceived that the REDD+ pilot projects will influence the agricultural sector by providing more extension services to local communities to improve crop productivity and mangrove conservation. Agricultural extension officers are concerned about the current situation of prolonged droughts and declining trends in crop productivity. In response to this concern, extension officers are emphasizing the use of high-yielding and short-maturing crop varieties, which all respondents in the study area indicated that they already are. The most common types of high-yielding short-maturing varieties used are *saro* (rice), *kiroba* (cassava) and *katumani* (maize).

Management of flood risks

Increased flooding could affect mangrove health and species composition due to changes in salinity, recruitment, and changes in the wetland sediment budget, and it may cause mangroves to migrate and outcompete salt marsh vegetation (McLeod and Salm, 2006). Communities in the study areas are expecting that the projects will help them to raise awareness on the importance of conservation and build capacity to manage risks of damage to mangrove forest and livelihoods associated with floods. For example, the *El Nino* rains that occurred from 1997-98 caused massive death of mangroves in the Gazi Bay due to flooding. In response to this hazard, planting of appropriate mangrove species in the affected area was initiated by KMFRI. The activity proved positive since it helped to restore the degraded mangrove area (Plate 8). Restoration of degraded mangrove forests offer potential to reverse GHG emissions and enhance existing carbon stocks (Kairo *et al.*, 2001).

The majority (77%) of respondents in the Mchinga and Mfisini villages reported that flooding of the Rufiji River continued to occur in some parts of the Delta, which had caused bank erosion and diversion of water courses. Government officials in Tanzania are concerned about the risks associated with floods in mangrove forests and the life of people. The MMP in the Rufiji Delta, for example, conducted a 5-day eviction exercise of farmers in the mangrove forest to protect people from flood risks. In the Cheju village, the majority (80%) of respondents indicated low expectations of their settlements to be affected by floods because settlements are not located on low lying area.

Advocating the application of fertilisers and pesticides

All respondents in the *Mchinga* and *Mfisini* villages indicated low expectations on the REDD+ project to support the application of fertilizers and pesticides on rice farms. The application of pesticides in rice fields in mangrove forests is discouraged by agricultural extension officers to avoid pollution in the estuaries and marine environments. None of the villagers indicated that they apply fertilizers on the rice fields but admitted to the application of pesticides, including DDT, in rice fields to kill crabs that are destroying seedlings. The use of DDT is illegal and therefore applied secretly.

All respondents in the Cheju and Pete villages indicated that they are applying inorganic fertilisers on their farms, including NPK to supply essential plant nutrients to enhance the growth and productivity of crops. The fertilisers are readily available at the shops. Pesticides are also used in the Cheju and Pete villages to reduce competition from unwanted plants and insects in agricultural crops.



Plate 8. Planted mangroves in area affected by *El Nino* rains at Gazi Bay, Kenya (Photo R. Kitula, 2012)

PRE-CONDITIONS FOR INCREASED IMPLEMENTATION OF REDD+ ACTIVITIES IMPLEMENTED IN MANGROVE FORESTS

Below are some of the pre-conditions that were identified during the survey as required for increased implementation of the REDD+ activities in mangrove forests.

Signing the agreement

Kenya and Tanzania were found to be eligible countries to implement REDD+ activities in mangrove forests because they have ratified the Climate Change Convention. Furthermore,

the governments of the two countries were found to be committed to the REDD+ readiness process and are participating actively in international REDD+ negotiations. They signed a Letter of Intent on a Climate Change Partnership with a focus on supporting REDD+ pilot activities and proposals, including in-depth studies, research, capacity building activities, policy reviews and concrete REDD support aimed at benefiting communities.

Developing National REDD+ strategies

The development of national REDD+ strategies was the first step in the implementation of REDD+ activities. Both Kenya and Tanzania have started developing such strategies, which are important for accessing funds from the UN-REDD Programme to protect forests and decrease GHG emissions (Angelsen, 2008). Harvey *et al.* (2012) and URT (2012) added that the development of national REDD+ strategies will help to guide the implementation of REDD+ activities and benefit a post-2012 internationally approved system for mangrove forest carbon trading, based on demonstrated emission reductions from mangrove deforestation and degradation (Kauffman and Donato, 2012). A number of processes were followed in the development of the strategies, including multi-stakeholder consultations to ensure that all key perspectives are considered, identification of drivers of mangrove deforestation and degradation. Finally, sharing draft strategies with various stakeholders at different levels was done. This ensured that stakeholders' concerns are adequately addressed. The strategies were accompanied by action plans which guide implementation of REDD+ activities in the countries.

Project eligibility

The study showed that mangrove forests in the Gazi Bay, Rufiji Delta and Unguja Island are eligible for Voluntary Carbon Standard (VCS) crediting since mangroves in these areas have met the internationally accepted definitions of what constitutes a forest. Project activities, such as avoided deforestation and improved forest management, are implemented on land that is formally defined as forest and address reduction of degradation and conversion of natural mangrove forests to non-forest land while enhancing carbon stocks of degraded and/or secondary forests that would be deforested in the absence of REDD+ activities.

Mangrove forests in the project areas are also eligible for the VCS because they have a long history of being degraded and removed before the REDD+ pilot projects were initiated. For example, from 1980 to 2010, mangrove forests in the Rufiji Delta alone were reduced by more than 5 000 ha, and in the Gazi Bay area forests have been extensively used and degraded, with large areas clear-felled in the 1970s. Since then, there has been almost no regeneration due to effects resulting from the large scale clearance, intensified wave action and erosion at low shore sites, and increased salinity at high shore sites.

In-depth studies

In-depth studies on relevant existing policies, legal and institutional arrangements were conducted to better understand the implications of REDD+ strategies and to develop appropriate arrangements for effective implementation of REDD+ programme activities (Jumah *et al.*, 2009; Silima *et al.*, 2009; FORCONSULT, 2010; Gichu, 2010; LEAT, 2010; Mwakajale *et al.*, 2010; Blomley and Tennigkeit, 2012; Regalia Media, 2012). This was done because the successful implementation of REDD+ programmes requires a clear institutional setup that will effectively support the village conservation committees and ensure security of forest tenure to community groups engaged in REDD+ activities (CARE, 2010; Gichu, 2010; Angelsen *et al.*, 2011).

Knowledge on drivers of deforestation and degradation

Achieving certification under REDD+ requires project developers to have a good understanding of the drivers of deforestation in the target area (Regalia Media, 2012). REDD+ projects need to show that they can reduce or remove these drivers. KMFRI, CARE International and WWF were found to be knowledgeable on the drivers of mangrove deforestation and they have shown in the Project Idea Note (PIN) that they will reduce these drivers (CARE, 2010; Mikoko Pamoja, 2010). At Gazi Bay, mangrove forests are lost through legal and illegal extraction of wood for poles, timber and fuelwood (Mikoko Pamoja, 2010). In the Rufiji Delta, forests are disappearing due to conversion to rice (Plate 2A) and salt dams (Plate 3A) as well as pole and timber harvesting, invasive species, livestock grazing (Plate 9), and firewood collection (Wagner, 2008). In Zanzibar, the drivers of mangrove deforestation identified during feasibility studies of the HIMA project are fuelwood gathering, charcoal making, cutting poles, seaweed stick collecting, livestock encroachment, invasive species, and firewood for lime production (CARE, 2010). The most significant underlying causes of deforestation and degradation of mangrove forests in the study areas were quite similar, including increased population pressure, poverty, insecure land tenure, inadequate economic incentives for sustainable forest management to compete with alternative land uses, and limited institutional capacity to deliver extension services.



Plate 9. Livestock grazing in the newly planted mangroves in the Rufiji Delta, Tanzania (Photo R. Kitula, 2012)

Leakage prevention activities

For the REDD+ project to be eligible for VCS credits, developers are required to indicate activities that will prevent leakage of GHGs. The *Mikoko Pamoja* project has established a *Casuarina* plantation on Gazi primary school's compound for firewood and timber production on a five-year rotation. This plantation will help to prevent carbon leakage by providing a source of firewood and timber instead of material currently taken from the mangroves. It will also provide income to the community fund by selling poles giving a reliable financial return on the project within the first five years. This will supplement the less secure return from carbon sequestration and help ensure project sustainability. In addition to harvesting commercial poles branches will be used as a source of firewood.

Discussions with CARE International officials in Tanzania revealed that the HIMA project is planning to reduce leakage by establishing alternative supplies of biomass. In this endeavour, the project is expected to work closely with community members, including women and poor people, to improve land use and support tree production and planting. Growers will be supported through services facilitated by the project, such as knowledge and inputs for nursery establishment and management. At the same time, the benefits of using fuel efficient stoves will be promoted, in order to reduce fuel use while trees are maturing. Long term roll-out of this activity will be funded from future carbon payments to ensure sustainability.

Capacity building

Enhancing capacity is important to equip stakeholders with necessary skills to benefit from emerging opportunities associated with REDD+. This is a new policy initiative requiring intensive application of new and partly complex technologies in many areas. The capacity and infrastructure for effective implementation of the carbon accounting system are still limited, especially in the areas of modelling, GIS simulation, monitoring and evaluation, and carbon stock assessments, all of which are needed at all levels (Angelsen, 2008; URT, 2011). In connection with this, a 5-year programme known the “Climate Change Impacts, Adaptation and Mitigation” (CCIAM) was initiated in 2009 in Tanzania. It is implemented by the Sokoine University of Agriculture (SUA), and it was initiated to develop and sustain adequacy in national capacity to participate in climate change work. Particular emphasis is given to REDD+ initiatives, research projects on REDD and PFM sites. Despite this effort, capacity building and infrastructure development were generally inadequate at all levels in Tanzania.

Carbon baseline for REDD+ projects

Setting up robust and transparent monitoring, reporting and verification (MRV) systems for REDD+ pilot projects will enable an understanding of carbon stock and forest cover changes, provide a basis for payment distribution, show evidence of emission reduction, and certify areas of REDD+ interventions and actions (UNFCCC, 2009). Therefore, an MRV system is important for estimating gross emissions from mangrove deforestation and degradation in a specific location over time.

In Kenya, researchers from KMFRI have used GIS mapping to assess deforestation rates in mangrove forests to create a baseline, which means that mangroves can be included under any national REDD+ strategy, thereby greatly improving the potential for REDD+ activities in mangrove forests. Literature shows that there is detailed information on above- and below-ground carbon for different mangrove types in Gazi Bay (Kirui *et al.*, 2006; Kairo *et al.*, 2009). These forests cover 615 ha. Estimates show that above-ground biomass in this area is about 250 t/ha while below-ground biomass (to 60 cm depth) varies from 7.5 - 75 t/ha. This correspond to about 155 000 tC above-ground and 23 250 tC below-ground in the total Gazi mangrove area. In addition, mangroves sequester around 1.5 tC/ha/yr in increased organic matter in sediments, and about 5 tC/ha/yr on average in new biomass. Hence, the forest sequesters an additional ~4030 tC every year (Mikoko Pamoja, 2010). As a pilot, *Mikoko Pamoja* project proposes to utilise 177 ha of mangrove forest in Gazi Bay. Baseline information reveals that initial *Mikoko Pamoja* project activities, viz. avoided deforestation (for the 100 ha natural mixed mangrove forest), reforestation of 7 ha *Rhizophora* plantation and reforestation of 10 ha new plantation (*Sonneratia*), resulted in a net accumulation of c. 2023 tCO₂ per annum, yielding USD 12 138 annual income from carbon credit, assuming that the price is USD 6 per ton CO₂ (Mikoko Pamoja, 2010).

In mainland Tanzania, an inventory of mangrove forests was carried out in 2011 under the NAFORMA project. During the time of this study, processes were underway to organise and analyse the collected inventory data to provide information on the state and trends of forest resources. A forest inventory in Zanzibar started in October 2012 under the Wood Biomass Survey (WBS) project. The inventories in both mainland Tanzania and on Unguja Island were useful in providing important forest based biomass data to feed into a national carbon accounting system (URT, 2009).

The methodology applied by the NAFORMA and WBS projects were based on a grid of permanent sample sites that were initially assessed (surveyed) and then monitored at regular future intervals. The assessment involved collection of both biophysical and socio-economic data. The former were collected to provide information on the extent and condition of the mangrove forests and trees outside forests, and captures deforestation and mangrove forest degradation rates through re-measurements. The collection of socio-economic data was aimed at providing knowledge about the human factors that affect changing mangrove forest conditions in Tanzania (driving forces for forest change) and potential REDD+ linkages (ecosystem services) (URT, 2009). According to Kauffman and Donato (2012), tracking the state and trends of mangrove forest resources at regular intervals is important for successful implementation of REDD+ projects. Consistently and accurately monitoring changes in mangrove forest cover and carbon stocks over time enable assessment of progress made in reducing forest-related emissions (Angelsen *et al.*, 2011). This provides the basis for measuring REDD+ success.

CHAPTER 5 Best REDD+ practices and approaches in mangroves in Eastern and Southern Africa and their potential for up-scaling

Table 6 gives a list of the best REDD+ practices and approaches in mangrove forests which were identified during the Participatory Rural Appraisal (PRA) exercises and interviews of key informants.

RESTORATION

Mangrove forest restoration was considered the best practice with regard to its contribution to climate change mitigation as it ranked first with a score of 45. This was in part due to the fact that mangrove trees easily regenerate both naturally and artificially, facilitating, among other things, erosion control and mitigation of environmental damage (Primavera, 1995; Kairo *et al.*, 2001). Restoration of mangroves was reported by respondents to be simple as the ripe fruit and young mature seedlings are readily available in the forest. Stakeholders, including WWF, MACEMP, MMP, CARE International and KMFRI, are working in the study areas to facilitate planting of trees by local communities. These communities participate in planting exercises by providing free labour. The challenge associated with restoration of mangrove forests is that seed collection is fairly expensive in terms of time and labour. The mangrove areas that were clear-felled in the 1970s have demonstrated that replanting is possible at these sites and can lead to positive ecosystem changes, but it requires trees to be raised in nurseries and transplanted after six months, which is labour and capital intensive (Mikoko Pamoja, 2010).

SUSTAINABLE FOREST MANAGEMENT

Sustainable management of mangrove forest ranked second among REDD+ practices with the score of 41 (Table 6). It is designed to attain a balance between society's increasing demands for forest products and benefits, and the preservation of forest health and diversity. This balance is critical to the survival of forests, and to the prosperity of forest adjacent communities. Communities must be allowed access to mangrove resources, but in a way and at a rate that maintain their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and

social functions without causing damage to other ecosystems. Sustainable management of mangrove forest should, when properly designed and executed, have significant carbon benefits, as well as community and biodiversity benefits.

RAISE COMMUNITY INCOME GENERATION

In the study area, improving community income generation was considered one of the best REDD+ approaches, ranking third with a score of 27. Crop farming, harvesting of mangrove forest products and fishing were the main sources of household income. Agriculture used traditional technologies and fishery was conducted using canoes. The use of old technologies and equipment was associated with low output and resulted in even more mangrove forest harvesting and encroachment through shifting cultivation. Stakeholders, including MACEMP, TASAF and the Rufiji Environmental Management Project (REMP), had been involved in raising community income with the intention that this would enhance conservation of mangrove forest. They were fairly active in promoting livelihood activities including fish farming, large scale salt making, modern fishing, modern beekeeping and fattening of crabs. Some of these activities were found to accelerate deforestation and degradation of mangrove forests. For example, mangrove trees were sometimes cut down illegally to collect juvenile crabs for fattening. Salt making in mangrove forests was associated with cutting down trees to make room for salt pans. This indicates that the absence of environmentally friendly alternative income generation for households is likely to contribute to increased deforestation and degradation of mangrove forest in the study area. Therefore, improving community income generation through environmentally friendly livelihood activities, e.g. through eco-tourism, butterfly farming, small business, formal employment, processing non-timber forest products (NTFPs), and using modern fishing methods and equipment, could have high potential to contribute to climate change mitigating in mangrove forest.

Table 6. REDD+ practices and approaches in mangrove forests in Kenya and Tanzania

REDD+ practices and approaches	Scores by village						Total score	Rank
	Kenya		Tanzania					
	Gazi Bay		Rufiji Delta		Unguja Island			
	Gazi	Makongeni	Mchinga	Mfisini	Cheju	Pete		
Restoration	9	9	5	5	8	9	45	1
Sustainable forest management	8	8	4	4	9	8	41	2
Raise community income generation	4	6	1	2	7	7	27	3
Boundary demarcation and social fencing	5	4	3	3	5	4	24	4
Strengthening forest land tenure	6	5	NA	NA	6	5	22	5
Strengthening community based organizations	7	2	NA	NA	3	6	18	6
Avoided deforestation	3	7	0	0	0	0	10	7
Support exchange visits	2	0	2	1	2	1	8	8
Establishment of woodlots	1	1	NA	NA	4	3	9	9
Climate change awareness workshops	0	3	NA	NA	1	2	6	10

BOUNDARY DEMARCATION AND SOCIAL FENCING

Boundary demarcation of specific project parcels was one among the better REDD+ approach, ranking fourth with a score of 24 (Table 6). Key informant interviews indicated that legal protection alone is insufficient to prevent mangrove deforestation and degradation. Therefore, a physical boundary is required to avoid deforestation, and this activity supplements social fencing and patrolling. Some tools available at the study sites, including the installation of fences, gates, boundary poles (Plate 10), and signs, will provide local communities with a transparent, recognisable and fixed boundary of the project area. Ostrom (1994) reported that the presence of clearly defined boundaries of the CPR itself is likely to increase commitments of local communities in the management of CPR.

STRENGTHENING FOREST LAND TENURE

The study showed that strengthening the tenure of forest land was seen as an important REDD+ approach, ranking fifth with a score of 22. This was due to the perception that increased security of forest land tenure tends to result into decreased illegal use of forest resources (FOCONSULT, 2010; LEAT, 2010). Through CFAs and CoFMAs, communities in Gazi Bay and on Unguja Island have entered into agreements with the governments to manage mangrove forests close to their areas, even if these mangroves are gazetted forest reserves and managed by the states. In other words, land tenure laws in Kenya and on Unguja Island are not secure enough to encourage people to make long term investments in mangrove forests, and thus in REDD activities. Therefore, the *Mikoko Pamoja* and HIMA projects intend to strengthen policies and laws to support the recognition of each specific CFA and CoFM project site (identified with GPS coordinates), as managed by a specific community with a recognised governance structure and with defined sustainable management plans approved by the government.



Plate 10. Woodlot fenced by poles at Gazi Bay, Kenya (Photo R. Kitula, 2012)

STRENGTHENING COMMUNITY BASED ORGANISATIONS

Strengthening community based organisations, i.e. CFA and VCCs and their umbrella bodies including JECA and **SEDCA**, ranked fifth with a score of 18 among the REDD+ approaches in mangrove forest (Table 6). The study showed that REDD+ pilot projects were involved in the training of these committees on issues such as silviculture, forest governance, financial management, leadership skills, gender issues, conflict management and addressing some of the drivers of deforestation. Training on these topics are important for implementing climate change mitigation activities in mangrove forests since they will increase the capacity of these conservation committees to deliver forest extension and advocacy services.

AVOIDED DEFORESTATION

Avoided deforestation ranked only seventh because this approach was seen to have disadvantages to mangrove dependent communities as the practice require that mangrove forests be put under strict protection. Forest protection leaves forests almost entirely intact by closing them off to production and extractive use.

SUPPORT EXCHANGE VISITS

Supporting exchange visit was an approach designed by the *Mikoko Pamoja*, HIMA and WWF projects (Table 6). For example, the HIMA project is expected to support a number of

exchange visits of Zanzibar partners to mainland sites and from the mainland to Zanzibar sites during the life of the project. This was suggested based on the fact that lessons from the Island may be different from the mainland, but useful to REDD activities in the mainland and vice-versa. This suggests that support of exchange visits is a potentially important REDD+ approach since it helps to build capacity, generate knowledge and information sharing.



Plate 11. Privately owned woodlot in Cheju village, Tanzania (Photo R. Kitula, 2012)

ESTABLISHMENT OF WOODLOTS AND TREES ON FARMS

In the study areas, establishment of woodlots and trees on farms was reported during PRA exercises as one REDD+ approach in mangrove forests. Communities in Gazi Bay and individual households in the Cheju and Pete villages have established woodlots using exotic tree species (Plate 11). In these villages, woodlots have formed a major source of firewood and poles for domestic use and for sale, indicating that encouraging communities and individuals to establish woodlots and trees on farms will meet increasing demand for wood and NWFPs in rural and urban areas. This is important for the conservation of mangrove forest and increasing carbon stock.

CLIMATE CHANGE AWARENESS WORKSHOPS

Climate change awareness workshops with political leaders were reported during PRA exercises as one among the REDD+ approaches in mangrove forest (Table 6). Key informant interviews revealed that support from senior political leaders will be crucial for the successful implementation of the REDD+ activities. Therefore, the projects have planned to

organise REDD and climate change awareness workshops for senior political leaders each year during the life of the project.

CHAPTER 6 Other relevant climate change mitigation activities in mangroves in Eastern and Southern Africa and their potential for up-scaling

The study identified ten other relevant climate change mitigation activities in mangrove forests in Kenya and Tanzania that are potential for up-scaling (Table 7). It was found that the REDD+ activities are not only restricted to the forest sector, but also encompass the agriculture and other natural resources sectors. These other activities include:

INTENSIFICATION OF AGRICULTURE

The results from ranking and scoring analyses showed that agricultural intensification with a score of 38 was the best activity in mitigating the impacts of climate change in mangrove forest (Table 7). Tanzania has promoted intensification of agricultural production systems to counteract the impact of changes in climatic condition for many years. Currently, the campaign for agricultural revolution popularly known as *Kilimo Kwanza* (KK) emphasises intensification of agriculture through irrigation, efficient use of inputs, effective marketing and sustainable use of natural resources to increase productivity and income (URT, 2011). Experience has showed that increased agricultural productivity and incomes tends to reduce dependence and pressure on mangrove forest resources. This in turn is leading to increased conservation and providing significant benefits for forest carbon and biodiversity (Silima *et al.*, 2009). Therefore, such activities, although not labelled as REDD+ activities when they were designed, can contribute to REDD+.

The presence of large expanses of seasonally flooded non-forested land was found to have a potential for increased rice and bean production in the Cheju village, where nearly 80% of households farmed in this area. Very few (10%) households in the village indicated that they are engaged in the cutting of mangrove poles. This situation was different from the Mchinga and Mfisini villages where mangrove deforestation for rice farming occurs due to lack of suitable land for farming in most parts of the Rufiji Delta due to salinity and acidic condition (Kajembe, 2000). This means that intensification of crop production into non-forested land (Plate 12) not currently used for agriculture is likely to enhance mangrove forest conservation.



Plate 12. Non-forested land suitable for agriculture adjacent to mangrove forests in the Rufiji Delta, Tanzania (Photo R. Kitula, 2012)

DEVELOPING APPROPRIATE MANAGEMENT PLANS

The results in Table 7 show that developing appropriate management plans relevant for specific zones can result in sustainable management of mangrove ecosystems. For example, efforts have been made to categorise all mangroves in Tanzania into four management zones to ensure sustainable management. Zone I receives total protection, and includes mangroves that protect the coast from wind and sea erosion, maintain genetic resources and protect flora and fauna. Zone II are production forests that are ecologically stable areas with sufficient regeneration potential to permit controlled harvesting. Zone III are degraded areas requiring rehabilitation by being closed for cutting for varying periods of length to allow recovery. Zone IV are areas set aside for different types of development (Semesi, 1992; Makame *et al.*, 2002). Despite the presence of these management zones, mangrove forests are harvested in a haphazard manner due to lack of appropriate management plans relevant to the specific zones.

Table 7. Ranking order of other relevant climate change mitigation activities in Kenya and Tanzania

Other climate change mitigation activities	Scores by village						Total score	Rank
	Kenya		Tanzania					
	Gazi Bay		Rufiji Delta		Unguja Island			
	Gazi	Makongeni	Mchinga	Mfisini	Cheju	Pete		
Intensification of agriculture and fishing	6	6	6	6	7	7	38	1
Developing appropriate management plans	5	5	5	5	5	5	30	2
Participatory management	3	3	4	4	4	4	18	3
Enforcement of forest law and regulations	4	2	3	2	3	3	17	4
Opening and closing system	NA	NA	NA	NA	6	8	14	5
Community based ecotourism	2	4	NA	NA	NA	6	12	6
Taungya system	NA	NA	2	3	NA	NA	5	7
Enforcement of land use laws and regulations	1	0	1	1	0	1	4	8
Sacred groves	0	1	NA	NA	2	0	3	9
International reputation	NA	NA	0	0	1	2	3	10

PARTICIPATORY FOREST MANAGEMENT (PFM)

PFM is one type of climate change mitigation activities in mangrove forest in which local communities undertake activities which are geared toward the sustainable use of forest resources. In many countries, CoFM has been promoted as a strategy for promoting management aiming at curbing deforestation and forest degradation. The assumption is that

under the management of village governments, forests will recover because encroachment is reduced, unregulated activities decline and game numbers increase. These efforts provide a value basis for rapid REDD+ readiness. There is evidence that PFM, where successfully applied, has reduced deforestation, generated more sustainable income streams for communities and contributed to the acquisition of technical skills (Blomley and Tennigkeit, 2012).

EFFECTIVE ENFORCEMENT OF FOREST RULES AND REGULATIONS

Effective enforcement of forest rules and regulations was mentioned as another strategy of climate change mitigation in mangrove forest (Table 7). The obvious idea is that illegal activities in mangrove forest are likely to decrease by more effective enforcement of forest rules and regulations. Trend analyses showed that such enforcement stimulated the occurrence of many small mangrove plantings for mitigating environmental damage. As an example, mangrove planting in Lamu (Kenya) was already done after trees were clear-felled during the First World War (1914-18) by the Smith and McKenzie Company (Kairo *et al.*, 2001). Attempts to replant mangroves in the abandoned rice fields in the Rufiji Delta were initiated in the 1990s by the government of Tanzania in collaboration with the Norwegian Agency for Development (NORAD). This replanting was reported by local communities to be successful, probably because of both environmental factors and good species selection.

OPENING AND CLOSING SYSTEM

The harvesting of mangrove poles and timber through a system of opening and closing of management zones could be another strategy of climate change mitigation. In past years, harvesting of mangrove forest on the Unguja Island was done through a specific opening and closing cycle of not more than 10-15 years. In this system, decisions for either closing or opening a management zone were jointly taken by the government, local councils and villagers, which together signed an agreement to this effect. Before such decisions, mangrove forests management councils were required to inspect the different areas. This approach increased a sense of ownership as communities perceived that mangrove forests are their property and their willingness to participate in forest protection increased (Kitula, 2012). This in turn helped to improve forest conservation. Focus group discussions indicated that under the opening and closing system, mangrove resources were large and plentiful, the level of utilisation was relatively low and the availability of quality poles was high.

The Zanzibar government has shown interest in managing and maintaining mangrove forest reserves by revising the forest policy of 1995. The opening and closing of mangroves are now declared by the government. Communities therefore perceive that mangroves belong

to the government only. This perception led to more illegal activities in the mangrove forests on Zanzibar. A more participatory system of opening and closing was seen by villagers as much better than the present system of government ownership in which the rights of local people are minimal. It could be another area of focus for REDD+ to promote such systems to improve sustainable harvesting of mangrove resources.

COMMUNITY BASED ECOTOURISM

Community based ecotourism was still another type of climate change mitigation approaches in mangrove forests (Table 7). Focus group discussions showed that income from ecotourism activities are benefiting local people and encouraging them to support conservation efforts. A turtle conservation centre in Pete village was found to play an important role in assisting the restoration of mangroves. Likewise, the mangrove boardwalks of Jozani (Plate 13A) and Gazi Bay (Plate 13B) contributed to mangrove forest conservation. Community based ecotourism has the potential to help communities to raise income as well as to raise awareness on the importance of conservation of mangrove forests. This in turn reduces illegal activities and increases carbon stock.

TAUNGYA SYSTEM

The study showed that applying the *taungya* system in mangroves can play an important role in climate change mitigation. Communities in the Rufiji Delta have participated in *taungya* developments in the past and are currently also engaged in same. This system involves growing rice in the early years of a mangrove plantation in order to utilise the land, control weeds, reduce establishment costs and stimulate the development of the trees (Plate 14). Due to shading effects some farmers in the Rufiji Delta vacated the mangrove areas and looked for new land for farming outside the mangrove forests.



Plate 13. Mangrove boardwalk at Jozani National Park, Tanzania (left) and Gazi Bay, Kenya (right) (Photo R. Kitula, 2012)



Plate 14. Taungya system in mangrove forest in the Rufiji Delta, Tanzania (Photo R. Kitula, 2012)

EFFECTIVE ENFORCEMENT OF LAND USE RULES AND REGULATIONS

Effective enforcement of land use rules and regulations was another strategy necessary for mitigating climate change impacts in mangrove forests (Table 7). Such rules and regulations are elaborated to promote and ensure wise use of mangrove land, guide resource allocations, prevent degradation of wetlands and mangroves, and resolve conflicts. Issues related to environmental management are recognised in the rules and regulations and they provide guiding principles to local authorities, which need clear mandates to take decisions on land use and resources. As an example, in Tanzania a campaign to survey village land took place in 2007 in which all villages that were located outside the mangrove forests were surveyed but not those located inside the Rufiji Delta. This implies that land use rules and regulations are discouraging establishment of permanent settlements within the mangrove forests. This is important for conservation of mangrove forests in the study area.

MAINTAINING SACRED GROVES

Beliefs related to mangrove sacred places were widely adhered to in Gazi Bay and on Unguja Island. It was taboo to cut mangrove trees in such sacred areas. There was no monetary fine or penalty for breaking the taboos, but rather people believed in supernatural sanctions. Sacred places were retained and conserved, among other reasons, due to a belief that they are home of ancestors. This means that such beliefs contribute in part to the protection of mangrove forests (Plate 15).

INTERNATIONAL REPUTATION

Increasing international recognition was observed to contribute in mitigating climate change in mangrove forests (Table 7). The results show that the roles played by mangrove forests have now been recognised globally and mangrove ecosystems are receiving great attention in the conservation agenda. At present, over 15 million ha of mangrove wetland in the world are under protection and sustainable use as part of the Ramsar Convention on Wetlands (COCATRAM, 2003). In addition, the protection of mangrove ecosystems in the Rufiji Delta in Tanzania has expanded since 2004 as the delta is under the International Ramsar Convention (WWF-EARPO, 2006). Increasing international recognition has attracted several stakeholders to promote conservation of mangrove ecosystem. For example, in Tanzania, WWF initiated the Rufiji-Mafia-Kilwa Seascape Programme (RUMAKI), which aims at addressing the fundamental links between environment and poverty and between biodiversity conservation and sustainable livelihood development. This is important for improving the socio-economic well-being of coastal communities through sustainable, participatory, and equitable use and protection of their marine and coastal natural resources. Therefore, promoting international recognition of mangrove areas participating in REDD+ could be another area of focus of the REDD+ since it aims at boosting mangrove productivity and reduce pressure of deforestation and degradation.



Plate 15. Sacred mangrove forest in Cheju village, Tanzania (Photo R. Kitula, 2012)

CHAPTER 7 Conclusions

The study established that the REDD+ activities in mangrove forests in Kenya and Tanzania were basically readiness and demonstration. They were implemented at all levels and they were not designed for mangrove forests alone. Along this line, the study confirmed that REDD+ is a multi-sectoral programme requiring cross-sectoral planning and coordination. Generally, there were very few REDD+ pilot projects implemented in mangrove forests in Kenya and Tanzania. Currently, in mainland Tanzania there are no REDD+ pilot projects *per se* in mangrove forests. Those found were just research projects for academic purposes. Therefore, REDD+ pilot projects in mangrove forests in mainland Tanzania should be encouraged so that mangrove dependent communities can benefit from the new funding initiative. Two REDD+ projects, viz. Mikoko Pamoja and HIMA, were piloted in mangrove forests in Kenya and Tanzania. Equally important is that the two projects potentially offer valuable lessons for realising REDD+ in mangrove forests.

Although lessons and experiences generated by different projects implementing REDD+ activities in other forests are highly demanded by the *Mikoko Pamoja* and HIMA projects, such knowledge is not easily available. Efficient communication and information sharing mechanisms for communities and various stakeholders to benefit from such lessons and experiences must therefore be put in place urgently. The study established that the use of various media to introduce the REDD+ concept and climate change issues helped to raise awareness of communities in carbon credit opportunities and in the importance of protection and conservation of mangrove forests. Informal institutional arrangements should be incorporated into REDD+ programmes to raise awareness and increase rules compliance. The capacity required to implement REDD+ pilot project activities was generally low at all levels in Kenya and Tanzania. In this endeavour, capacity building in the form of formal and informal training should be enhanced at all levels to ensure proper implementation of the REDD+ policy. The study indicated that the *Mikoko Pamoja* and HIMA projects were in the development stage meaning that processes were underway in Kenya and Tanzania to benefit from carbon funds as economic incentives to promote community livelihoods and justify the protection and conservation of mangrove forests.

The study confirmed that REDD+ projects are important in supplementing government efforts on community livelihood improvements and conservation of mangrove forests. Again, CFA, JFM and CoFM were identified as legal roads of acquisition of carbon rights after being granted a Forest agreement. The level of participation of communities in village meetings was low, especially in the Rufiji Delta. Therefore, stakeholders, including WWF, MMP and government staff working in the Rufiji Delta should encourage more participation

and legitimisation of village decisions instead of adopting village assembly minutes where only few residents attended and big decisions were made.

The study established that the distribution of financial rewards for protection and conservation may not be sufficient to offset the negative impacts at household level, particularly for poorer households, as a result of previous reliance on the mangroves for income generation. In its current form, therefore, the planned distribution of benefits will not compensate the poorest households for avoiding deforestation. Despite the fact that REDD+ projects were accepted in Tanzania, local communities wanted to be assured that carbon rights assigned to them to support livelihoods would really benefit them since they are key players in putting sustainable management of mangrove forest into practice without formal ownership of the forest land.

Mangrove restoration programmes should be enhanced in the area to increase the stock of carbon. Education and awareness programmes on REDD+ and climate change should be conducted frequently drawing stakeholders at all levels to enhance compliance regarding the use and management of mangrove resources. The study indicated that *signing the agreement, developing a National REDD+ strategy, project eligibility, in-depth studies, knowledge on drivers of deforestation and degradation, leakage prevention activities, capacity building, and carbon baseline for REDD+ projects* were the pre-conditions for increased implementation of REDD+ activities in mangrove forests.

Although they were not designed specifically for REDD+, but rather for land use intensification, the following factors were also shown to have potential for mitigating climate change impacts in the study area: *developing appropriate management plans, opening and closing system, participatory management, enforcement of forest law and regulations, community based eco-tourism, taungya system, sacred groves, enforcement of land use laws and regulations, and international reputation.*

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