

## Original Article

# Willingness and drivers of community participation in mangrove conservation in the Rufiji Delta, Tanzania

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## Abstract

Promoting local community participation in recognition of their indigenous knowledge is important for effective resource conservation. The aims of this study were to evaluate local community willingness and drivers of participation in mangrove conservation activities in the Rufiji Delta. Data were collected through focus group discussions, key informant interviews, semi-structured household interviews and participant and non-participant observations, across three designated management blocks - Northern delta (ND), Central delta (CD) and Southern delta (SD). Qualitative data were analysed using content analysis while quantitative data were analysed for descriptive and inferential statistics. Overall, the majority of respondents (88 %) agreed that it was important for the community to participate in mangrove conservation activities and 50 % of them expressed immediate readiness to participate if called upon. Zone wise, 50 % of respondents in ND and CD, and 42 % in SD indicated a moderate level of community willingness to participate in conservation. Age of household head, education level, source of income and awareness of mangrove governing laws were the most significant drivers positively associated with community willingness to participate in conservation activities. These findings suggest that for long-term management of mangroves, local communities should be adequately recognized as partners rather than as foes.

**Keywords:** willingness, mangroves, conservation, local communities, Rufiji Delta

## Introduction

Mangrove forests are intertidal ecosystems made of trees that have evolved to survive in wet, salty and often unstable environments (Spalding and Leal, 2021). They are special, unique and vulnerable ecosystems found globally in tropical and sub-tropical coasts (Astuti *et al.*, 2017). There are about 8,349,500 ha of mangroves globally (Romanach *et al.*, 2018) with Southeast Asia harbouring almost a third of the global total (Spalding and Leal, 2021). The Western Indian Ocean Region consists of 745, 518 ha of mangroves which represents 25 % of Africa's mangroves or 5 % of all the mangroves in the world. Mangroves in Tanzania cover an area of 110,787 ha with 41 % (45, 583 ha) located in the Rufiji Delta (Erftemeijer *et al.*, 2022).

There is a growing recognition of the role of mangroves in providing services that enhance livelihoods of millions of people, often the rural poor, by providing wood resources and support to fisheries. In addition, the role of mangroves in protecting coastlines and properties and ameliorating climate change-related impacts through their high capacity for carbon sequestration is increasingly appreciated (UNEP, 2014; Biswas and Biswas, 2019; Aye *et al.*, 2019; Gallup *et al.*, 2020; Spalding and Leal, 2021). Despite their recognized roles, mangroves are among the most threatened global ecosystems (Gallup *et al.*, 2020). Direct and indirect human pressures including conversion of mangrove areas to accommodate infrastructure, urbanization, aquaculture, agriculture and coastal tourism are some of the drivers for mangrove loss

globally (Romanach *et al.*, 2018; Goldberg *et al.*, 2020; Spalding and Leal, 2021). To address this situation, a number of countries have placed mangrove protection firmly into policy guidelines or framework legislation (Gallup *et al.*, 2020), which varies greatly across nations. Repeated calls to action, including reforms in policy and management strategies have been made (UNEP, 2014; Spalding and Leal, 2021) to support mangrove rehabilitation programmes in many countries throughout the world (Gallup *et al.*, 2020).

Like in other major mangrove countries of the WIO region including Kenya, Mozambique and Madagascar (Erfteemeijer *et al.*, 2022), Tanzania has not escaped mangrove degradation and loss, which is reported from various parts of the country including the Rufiji Delta which is the largest contiguous mangrove forest in the country (Monga *et al.*, 2018). Due to the high dependence of local livelihoods on mangrove areas and resources in the Rufiji Delta, the area has become a victim of a tacit common pool for firewood, charcoal-making, building poles, boat making and conversion to other land uses (Mangora *et al.*, 2016; Mwansasu, 2016; Mshale *et al.*, 2017; Monga *et al.*, 2018; Japhet *et al.*, 2019). These pressures have led to substantial degradation and loss of mangrove cover, where Monga *et al.* (2018) reported that between 1991 and 2015, 9,089 ha of mangrove forests in the delta were lost, translating to a net loss of 12.4 % in the period of 24 years, largely from conversion to rice farms.

To respond to repeated calls for protection and restoration of mangroves at different times, a number of government bodies and international conservation Non-Government Organizations (NGOs) such as the World Wide Fund for Nature (WWF) (Longopa, 2018), International Union for Conservation of Nature (IUCN) (Richmond *et al.*, 2002) and Wetlands International (WI) (Japhet, 2018) have funded conservation initiatives with components of protection and restoration of mangroves and promoting community participation in the Rufiji Delta. Reportedly, most of such initiatives are concentrated in the north delta block which is characterized by greater mangrove losses due to conversion into rice farming than the south and central delta blocks (Monga *et al.*, 2018). Local NGOs like Pakaya Culture and Environmental Group (PCEG) have also been conducting community sensitization and awareness raising in the delta to ensure sustainable conservation of mangroves. At the village level, Village Natural Resource Committees (VNRCs)

and Beach Management Units (BMUs) manage mangroves in the delta (Mshale *et al.*, 2017; Japhet, 2018; Nyangoko *et al.*, 2021).

Local community participation in natural resource conservation is gaining interest and encouraged in various countries and by various practitioners as an effective approach to ensure sustainability (Astuti *et al.*, 2017; Garekae *et al.*, 2017; Thuy *et al.*, 2019). This is due to the growing recognition that indigenous knowledge should be blended with contemporary conservation techniques to enhance the capacity to carry out long-term natural resource conservation plans (Ellison, 2012). However, it is evident in the literature that local communities in different areas have not actively participated in conservation programme planning and decision-making for various reasons (Kariuki, 2014; Gumede and Nzama, 2021). Participation is promoted as a voluntary process (Biswal, 2006), local community participation in natural resource conservation is not guaranteed because communities argue that their willingness is compromised by the absence of incentives (Zahabu *et al.*, 2010; Hassan, 2015). The Tanzanian Forestry Policy of 1998 and Forest Act of 2002 emphasize participatory management to achieve sustainable forest management through the Participatory Forest Management (PFM) framework (Zahabu *et al.*, 2010). The PFM has two strategies; Community-Based Forest Management (CBFM) and Joint Forest Management (JFM). In CBFM, a community becomes the forest owner and duty bearers of forest management, while JFM requires a community to sign an agreement with the government and other forest owners regarding forest management (MNRT, 2008). However, both CBFM and JFM strategies in Tanzania have not been effective and successful, not only in mangrove forests, but in some other terrestrial forest reserves where attempts have been made (Kajembe *et al.*, 2006; Mpokigwa *et al.*, 2011; Kilemo *et al.*, 2014). This is because there is no clear or binding agreements on how forest benefits and revenues are to be shared between the government and local communities (MNRT, 2008). An impact evaluation report by Persha and Meshack (2016) stated that JFM in Tanzania has enabled higher levels of local level governance, particularly the functions of VNRCs, but lacked in improving livelihoods of local communities participating in JFM, which calls into question the long-term sustainability of the strategy. These examples highlight why an adequate understanding of drivers influencing community willingness to participate in conservation in the

delta is important for designing and implementation of effective community-based mangrove conservation. In the present study, the willingness of local communities to participate in mangrove conservation in the Rufiji Delta was explored. The study specifically set out to answer the following questions:

## Materials and methods

### Study area

The Rufiji Delta lies between latitudes  $8^{\circ}20'00''$  and  $7^{\circ}35'00''$ S and longitudes  $39^{\circ}10'00''$  and  $39^{\circ}20'00''$ E. The delta is home to the largest mangrove ecosystem in Tanzania, with about 48,030 ha of mangrove for-

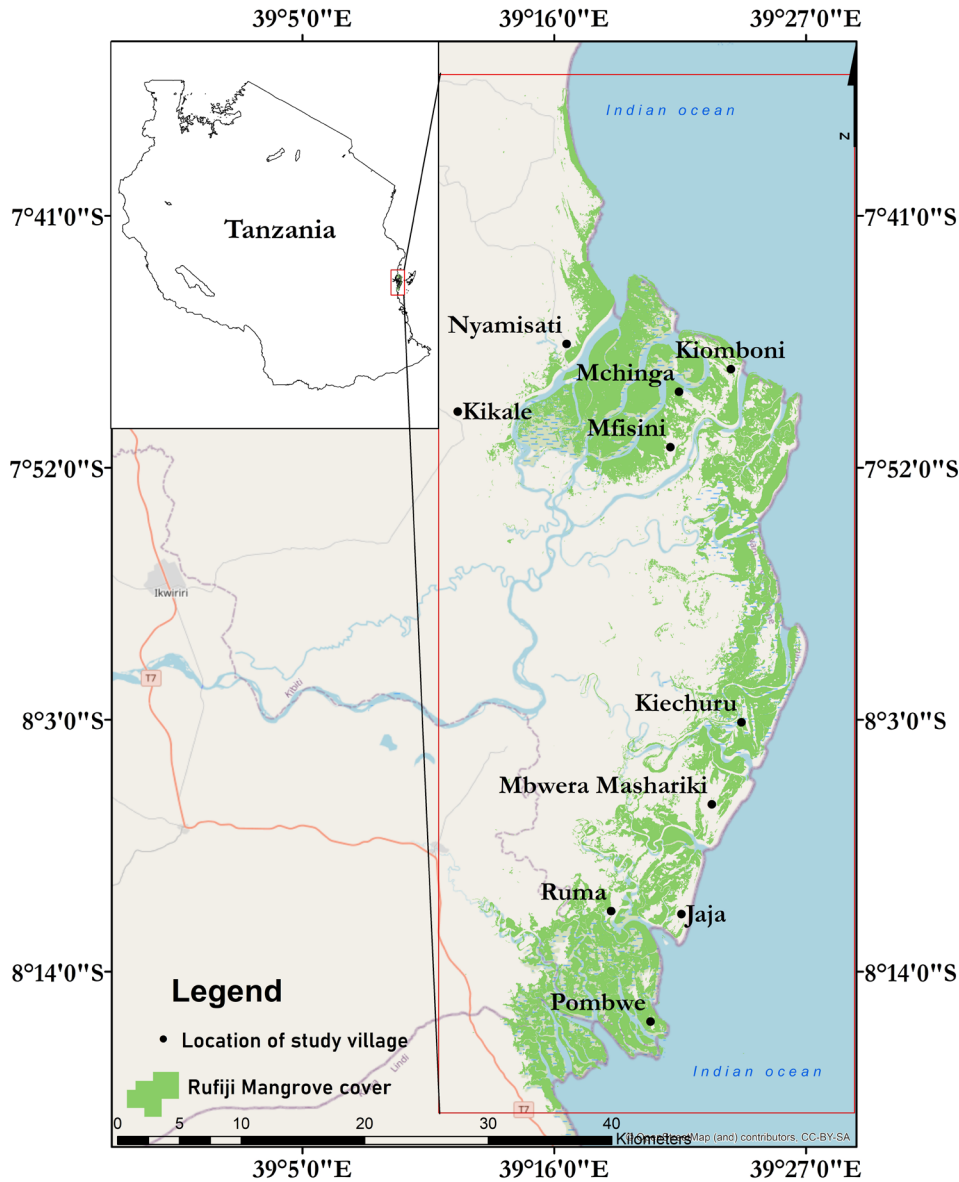


Figure 1. Map of Rufiji Delta showing location of study villages and mangrove cover.

(1) What is the importance of community participation in conservation?; (2) How do the local community perceive their role in participation in conservation initiatives?; (3) What is the level of community willingness to participate in conservation?; and (4) What are the drivers of community willingness to participate in conservation?

ests (Monga *et al.*, 2018). For management purposes, the delta is divided into three blocks; namely, Northern delta (ND), Central delta (CD) and Southern delta (SD) (Mangora *et al.*, 2016; URT, 2020). On the basis of proportional coverage of the forest and utilization and dependence of local communities on mangrove forest, ten (10) villages were selected for the study.

These are Mfisini, Kiomboni, Mchinga, Nyamisati and Kikale villages (North delta, which makes up 46 % of the mangrove area); Mbwera Mashariki and Kiechuru villages (Central delta, which comprises 28.5 % of the mangrove area); Ruma, Jaja and Pombwe villages (South delta, which contain 25.4 % of mangroves) (Semesi, 1992) (Fig. 1). Major livelihood activities in the delta include rice farming, fishing and trade of mangrove products (Kangalawe and Masao, 2018). Multi-ethnic groups live in the study villages, with the majority being “Ndengereko” and “Nyagatwa”. Other minor tribes who are mainly immigrants that reside in and around the Rufiji Delta include Zigua, Kurya, Matumbi, Makonde, Mwera, Zaramo, Ngoni, Ngindo, Shirazi and Hehe.

The Rufiji Delta experiences an average temperature of 24 °C and 28 °C during cold and hot months throughout the year, respectively (Ndesanjo *et al.*, 2012), with an annual rainfall of 750 mm to 1,250 mm (Mwansasu, 2016). The area experiences two rainy seasons; the short rains usually start in October and end in December, and the long rains are from February to May.

### Research design and data collection

Before the actual data was collected, a preliminary survey was carried out to introduce the objectives of the study and seek the consent of communities to

participate. The study applied a triangulation approach by using both qualitative and quantitative social science research approaches (Schoonenboom and Johnson, 2017) to gather primary data with increased credibility and validity at household and community level (Table 1). Qualitative research methods involved Focus Group Discussions (FGDs) and Key Informants Interviews (KIIs), while quantitative method involved Household Semi-Structured Interviews (HSSI). With the help of village leaders, simple random sampling was applied to select respondents who were knowledgeable about mangrove issues and activities, and of different ages and gender. All interviews, recordings, and photographs were conducted after receiving the verbal consent of the respondents, which is generally considered acceptable. Relevant and retrievable literature was collected and reviewed to complement information collected from primary data sources.

### Focus group discussions

In each village, one FGD was conducted at community level with six mixed sex participants (4 males, 2 females) of various age groups following a suggestion by Krueger and Casey (2018). Although coastal traditions make it difficult for women to speak in public, the FGD facilitator made sure that women participants were given adequate room to speak out. This helped to resolve the risk of bias in the results. The

Table 1. Research design including data collection and analysis.

Data collection	Method Description	Data collected	Data analysis
Community level	1 Focus Group Discussion per each village with 6 participants of different sex, age groups and livelihood occupation  32 KIIs (i.e., 10 village leaders, 10 Village Natural Resource Committee (VNRC) leaders, 10 village elders, 1 TFS DFC and 1 local NGO Pakaya Culture and Environmental Group leader	Community livelihood system, mangrove conservation issues (status, importance, threats, resource conflicts, conservation activities) and community perceptions on their willingness to participate in conservation (need, importance, level, drivers)	Content analysis
Household level	300 Households for semi structured interviews, 30 per each village	Socio-demographic characteristics, socio-economic conditions, community uses of mangrove areas and resources, mangrove conservation initiatives and community willingness to participate in conservation.	Descriptive and Statistical analysis
Participant and Non-participant observation	Engaging either directly or indirectly with local communities	Observed day-to-day activities and understand of real-world phenomenon of local community livelihoods and mangrove conservation	Content analysis
Literature review	Comprehensive review of related literature	Community willingness and participation in mangrove conservation, and the influencing factors	Content analysis



selected participants were residents who depended on mangrove resources for livelihoods, well-versed in mangrove issues and different mangrove-related livelihood occupations such as fishers, crop farmers, salt chefs, beekeepers, livestock keepers, fish traders, food and vegetable vendors, mangrove cutters, handcrafters, traditional healers and boat captains. Discussions were guided by a prepared checklist of questions, which were posed by the facilitator to allow participants to contribute their own ideas which were recorded on a flipchart. The checklist questions aimed at capturing information on community livelihood systems, mangrove conservation issues (status, importance, threats, resource conflicts, conservation activities) and community perceptions on their willingness to participate in conservation (need, importance, level, drivers).

#### *Key informant interviews*

A total of 32 key informants including village leaders, VNRC leaders, village elders, a Tanzania Forest Service (TFS) District Forest Conservator (DFC) and a local NGO Pakaya Culture and Environmental Group leader were interviewed using another prepared checklist of questions. The questions and interviews aimed to complement on issues raised in the FGDs and HSSIs in order to gain more understanding on village livelihood history, mangrove conservation initiatives and community willingness to participate in mangrove conservation.

#### *Household semi-structured interviews*

Prior to actual data collection, a household questionnaire was pre-tested to determine the reliability and applicability of the questions and revised accordingly. Two enumerators from each study village were selected and trained on administering household questionnaires using the Open Data Kit (ODK) on mobile devices. Following recommendation by Angelsen *et al.* (2011), a total of 300 households, 30 from each village were interviewed. The interviews were conducted with the heads of households, but in their absence, a household representative regarded to have sufficient knowledge and information about the household was interviewed. The questionnaire and interviews aimed to collect information on socio-demographic characteristics, socio-economic conditions, community uses of mangrove areas and resources, mangrove conservation initiatives and community willingness to participate in conservation. Questions on community perceptions of their willingness to participate in different conservation activities

(restoration, dissemination programmes, giving information on violation of laws, cooperating with government authorities in law enforcement, implementing alternative income activities, compliance to rules governing mangroves and formation of special groups for monitoring mangroves) involved statements in the form of a three-point Likert-scale 1= Disagree, 2 = Neutral, 3 = Agree (Hassan, 2015). The five-point Likert scale (1 = Very Low, 2 = Low, 3 =Medium/moderate, 4 = High, 5 =Very High) was used to record responses on the level of community willingness to participate in any conservation initiative. To minimize bias and ensure that respondents were not duplicated, the Geographical Positioning System (GPS) location of the respondent's home or workplace was registered.

#### *Participant and non-participant observations*

These observations involved directly or indirectly participating in community activities in order to physically identify socio-economic activities, mangrove forest resources and conservation activities. It was carried out to supplement the information from FGDs, KIIs, and HSSI and to better comprehend the real-world phenomena.

#### **Data analysis**

Based on Shannon and Hsieh (2014), qualitative data from FGDs, KIIs and observations was subjected to content analysis, where detected themes were highlighted and coded to assess and give meaning to the data as reported by respondents. Quantitative information collected from household surveys were analysed for descriptive and inferential statistics using SPSS Statistical software version 20 and Microsoft Excel 2010 for Windows. The binary logistic regression model was used to deduce the relationship between 10 independent variables (drivers) and one dependent variable (community willingness). Variable description is shown in Table 2. The model was chosen based on Sperandei (2014) because it can simultaneously analyse impacts of both continuous and categorical explanatory variables. The following logistic regression model was used:

$$\ln(\pi/1-\pi) = \alpha + \beta_i X_i + \beta_k X_k + e \dots\dots\dots(i)$$

Where:

- ( $\pi/1-\pi$ ) = Y is dependent variable,  $\alpha$  is constant at y-axis (intercept)
- $\beta_1$  to  $\beta_k$  are coefficients of regression
- $X_i$  to  $X_k$  are independent variables
- $e$  is the distribution error term of independent variables

Table 2. Description of variables used in logistic regression (Drivers of community willingness to participate in conservation).

Variables	Description	Modules of quantities
<b>Dependent variable</b>		
Willingness to participate in mangrove conservation	Whether community is ready to participate	Categorical, if yes=1, no=0
<b>Independent variables</b>		
Gender	Gender of household head	Categorical, 1=Male, 0= Female
Age	Age of household head	Continuous, Number of years
Education level	Education level of household head	Continuous number of years spent in school
Household size	Total number of members in household	Continuous, Number of members
Residence time	Length of time household settled in an area	Continuous, Number of years
Source of income	Main livelihood activity of household head	Categorical, 1= Mangrove based activities, 0= non-mangrove-based activities
Participation in mangrove conservation training	Whether household head has participated in mangrove training	Categorical, if yes=1, no=0
Knowledge on mangrove laws	Whether household head know any laws governing mangroves	Categorical, if yes=1, no=0
Participation in communal activities	Whether household head has participated in any communal activities	Categorical, if yes=1, no=0

## Results

### Socio-demographic characteristics

The socio-demographic characteristics of the study respondents are summarized in Table 3, indicating that more than 68 % of the interviewed respondents were male, and 56 % were in the age group of 18-45 years. Nearly 81 % of the respondents were married. The major ethnic groups were Ndengereko (71.8 %) and Nyagatwa (19.9 %). Nearly 60 % of respondents in ND reported a household size of 5-8 people, while less than 50 % reported this household size in CD and SD. In terms of literacy, over 63 % of respondents had primary education and 24 % had no formal education. Generally, about 45 % of the respondents had lived in the delta for 21-40 years. Mangrove-based rice farming was the major livelihood occupation of most respondents in ND (75 %) while about 43 % and 42 % reported to depend on non-mangrove-based crops farming in CD and SD, respectively.

### Participation in mangrove conservation

Responses to community perceptions on the importance of participating in mangrove conservation activities are summarized in Figure 2, indicating a significant difference ( $\chi^2 = 9.846$ ,  $p$ -value = 0.007) across study zones. Overall, more than 80 % of the respondents across the delta agreed that it is essential for communities to participate in mangrove conservation activities because they are natives with local knowledge of

delta areas, and the primary implementers of the initiated conservation activities. For example, one FGD respondent from ND disclosed that:

*It is crucial that the community get involved in mangrove conservation efforts since doing so will help us learn about conservation, provide us with income to meet our needs, and serve as the first custodians of these resources for the benefit of future generations.*

### Willingness to participate in mangrove conservation

The three study zones of the Rufiji Delta had different perspectives on their willingness to participate in conservation activities. Figure 3 presents community perceptions on seven conservation activities and the corresponding willingness to participate in such activities. Overall, over 70 % of respondents agreed that it was important to participate in all conservation activities. Mangrove restoration was in particular highly regarded as important by the majority (over 85 %) of respondents.

### Level of willingness to participate in mangrove conservation

Respondents were required to rank the level of community willingness to participate in conservation activities. Figure 4 presents the level of community willingness to participate in conservation, indicating a significant difference ( $\chi^2 = 29.204$ ,  $p$ -value = 0.000) on the level of community willingness between the three zones, where 60 % of respondents in ND and 50 % in

Table 3. Socio-demographic characteristics of respondents in the study sites (n=300).

Variable	Category	Percentage of responses			
		ND	CD	SD	Overall
Gender	Male	66.7	66.7	71.1	68.2
	Female	33.3	33.3	28.9	31.8
Age	18-35	23.3	43.3	25.6	30.7
	36-45	28.7	21.7	24.4	24.9
	46-59	25.3	20	21.1	22.1
	≥60	22.7	15	28.9	22.2
Marital status	Married	85.3	80	76.7	80.7
	Single	2	10	5.6	5.9
	Divorced	6	5	10	7
	Widower/widow	6.7	5	7.8	6.5
Tribe	Ndengereko	33.3	98.7	83.3	71.8
	Nyagatwa	58.7	0	1.1	19.9
	Hehe	1.3	0	3.3	1.5
	Konde	0.7	0	1.1	0.6
	Matumbi	2	0	6.7	2.9
	Zigua	0.7	0	0	0.2
	Ngindo	1.3	1.7	1.1	1.4
	Others	2.7	0	3.4	1.9
Household size	1-4	27.3	50	47.8	41.7
	5-8	59.3	45	48.9	51.1
	9-11	11.3	3.3	2.2	5.6
	12-15	2	1.7	1.1	1.6
Education level	No formal education	21.3	30	20	23.8
	Primary level	69.3	55	65.6	63.3
	Didn't finish primary	2	10	2.2	4.7
	Secondary level	4	3.3	6.7	4.7
	Didn't finish secondary	0.7	1.7	0	0.8
	Didn't finish advanced	0	0	1.1	0.4
	Adult education	2.7	0	4.4	2.4
Residence time	1-20	15.3	18.3	23.3	18.9
	21-40	40	56.7	36.7	44.5
	41-60	30.7	20	26.7	25.8
	61-80	13.3	5	8.9	9.1
	81-100	0.7	0	4.4	1.7
Source of income	Mangrove based rice farming	74.7	10	0	28.2
	Fishing	6.7	33.3	34.4	24.8
	Non-mangrove-based crops farming	4	43.3	42.2	29.8
	Mangrove harvesting	2.7	0	0	0.9
	Food vendors	0.7	3.3	6.7	3.4
	Livestock keeping	2.7	0	1.1	1.3
	Casual labour	2	0	0	0.6
	Formal employment	2	0	0	0.6
	Fish trading	0.7	0	2.2	0.9
	Driving	0	0	1.1	0.4
	Small business	0	3.3	7.8	3.7
	Boat captains	0	1.7	1.1	0.9
	Beekeeping	0	3.3	0	1.1
	Vocational works	3.3	1.7	3.3	2.8

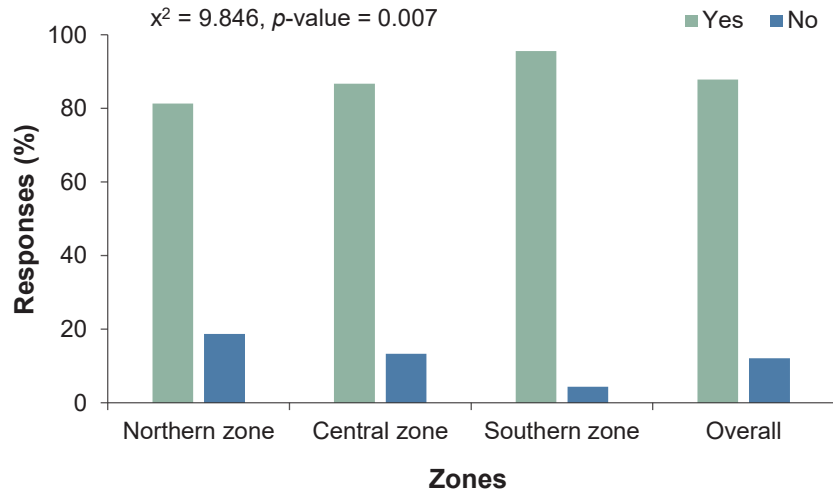


Figure 2. Percentage responses of importance of community participation in mangrove conservation activities in the study area.

CD indicated moderate levels of community willingness to participate in conservation, compared to 42 % of their counterparts in SD. Overall, only 6 % and 4.7 % of respondents agreed that the community could participate in conservation at very high and very low levels, respectively.

### Drivers of willingness to participate in mangrove conservation

Logistic regression analysis indicated four drivers (independent variables) were strongly associated with community willingness to participate in mangrove conservation in the study area, including age of household

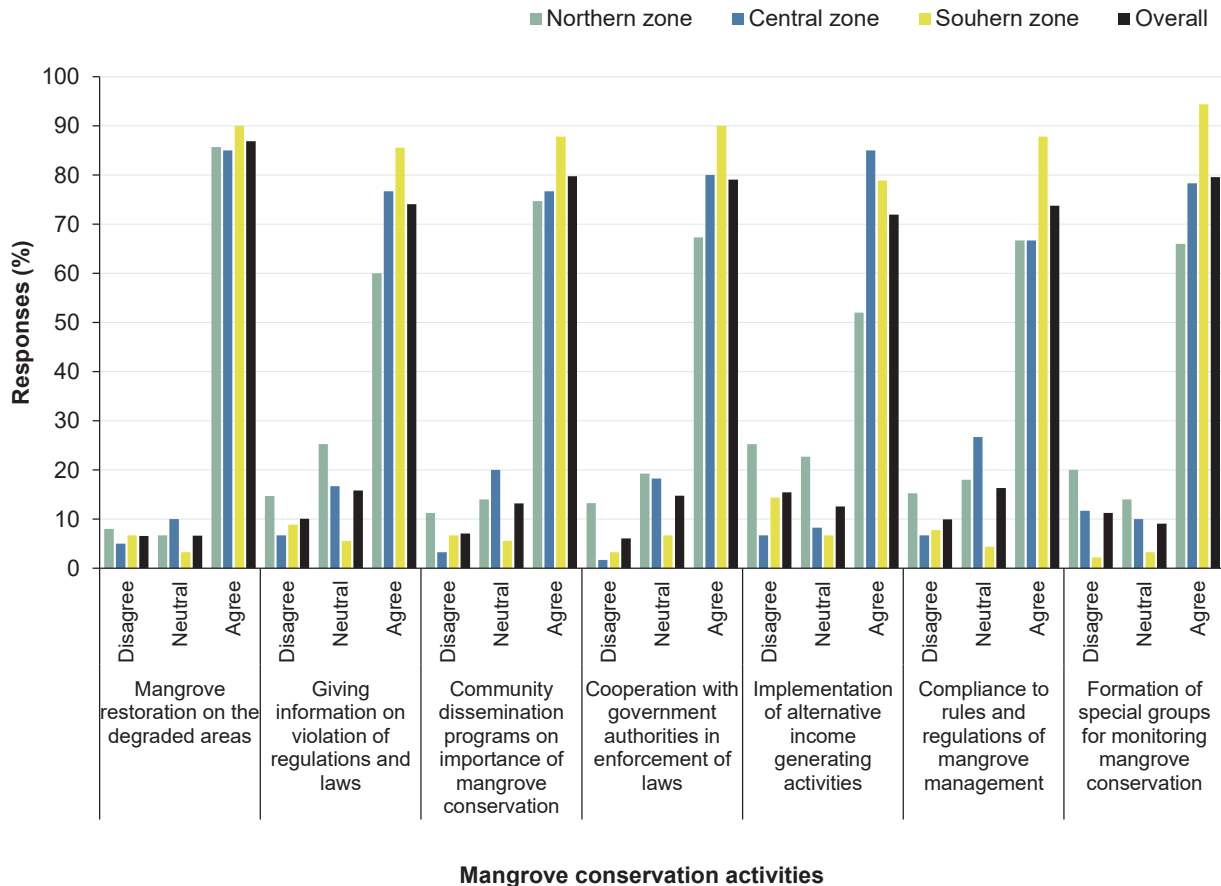


Figure 3. Responses on the list of conservation activities in which communities would be willing to participate in the study area.



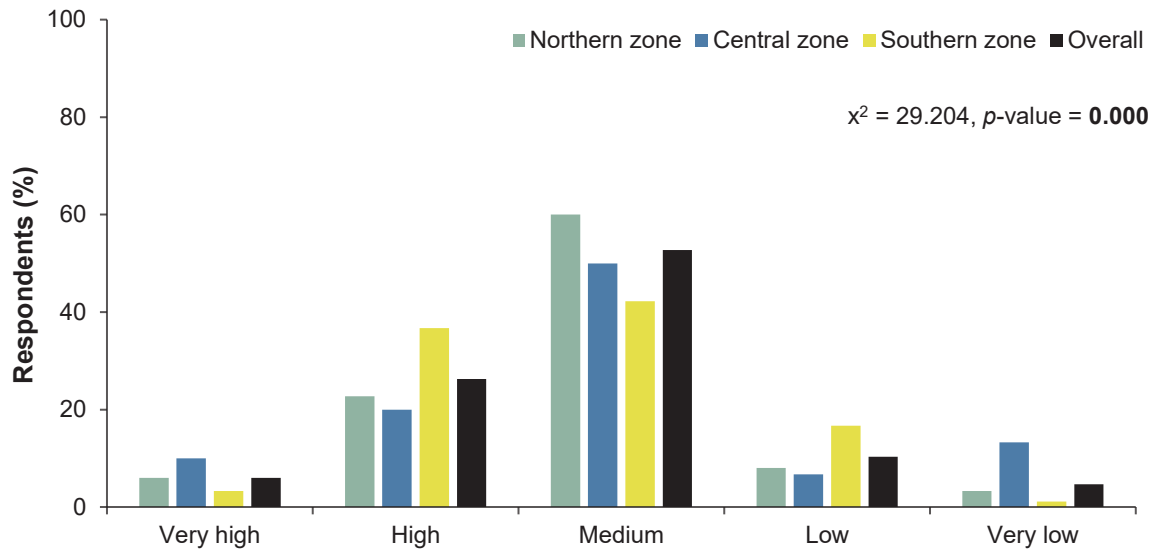


Figure 4. Level of community willingness to participate in mangrove conservation activities in the study area.

head, education level, source of income and awareness of mangrove governing laws. The coefficients of these variables were positive, and so a unit increase translated to an increase in number of people who were willing to participate in mangrove conservation by a factor of  $\text{Exp}(\beta)$ . The findings are summarized in Table 4.

## Discussion

Various government and non-governmental organizations such as TFS, WI, IUCN (Ntibona *et al.*, 2022), and environmental groups such as PCEG, VNRCs and BMUs (Mshale *et al.*, 2017; Japhet, 2018) working in the conservation field have extensively acknowledged the significance of community participation in conservation and management practices. In this study, 52 % of the respondents agreed to participate in various mangrove conservation activities in the study area. This implies that the local community in the study area is ready to take part as partners in conservation programmes. The key benefit of local community participation in conservation is that it effectively reduces protection costs in terms of time and money input by eliminating the need for outside technical expertise and human resources (Xu *et al.*, 2022). It was seen during interviews and discussion that the community is eager to be considered and included in conservation. Respondents articulated that it is essential for them to participate because they are natives of the delta, have enough local traditional knowledge to manage mangroves, use mangrove resources in their daily livelihoods and are able to implement conservation programmes for a longer period. Furthermore, their participation would increase public awareness on the

benefits of conservation. The benefits are categorized into ecological (good air quality, increased mangrove quality, coastal area protection, increased fisheries), economic (increased income, creation of job opportunities, addressing social needs), cultural (culture preservation, increased social values), and legal (provision of licenses and proper harvesting plans). Xu *et al.* (2022) reported that local communities in Southeast China were willing to take part in ecosystem conservation due to increased awareness on forest protection and the myriad of ecosystem services provided by forests which support their wellbeing. Sesabo *et al.* (2006) found that coastal villages in Tanzania were willing to support establishment of Marine Protected Areas (MPAs) as a conservation initiative due to economical, ecological and social benefits that will be accrued from the MPAs. In this study, about 53 % of respondents indicated a medium level of willingness to participate in conservation, indicating that there is increased awareness on mangrove conservation as a result of several awareness training programs established by conservation NGOs (WWF and WI) (Nyangoko *et al.*, 2021, Ntibona *et al.*, 2022). People who are aware of the environmental costs of their actions are more likely to support the relevant environmental management programmes (Kangalawe, 2012). Astuti *et al.* (2017) who carried out research in Demak, Indonesia reported that local communities in some villages indicated mixed high and low levels of willingness. The low level of willingness was due to recurring shoreline advances and periodic floods caused by industrial activities that damaged mangroves, causing communities to be less concerned about the importance of

Table 4. Results of logistic regression on determinants of community willingness to participate in conservation in the study area.

Driver variables	$\beta$	SE	Wald	<i>p</i> value	Exp ( $\beta$ )
Gender of household head	0.607	0.428	2.010	0.156 ns	1.835
Age of household head	0.914	0.273	11.173	<b>0.001*</b>	2.493
Education level	0.729	0.345	4.459	<b>0.035*</b>	2.073
Household size	0.013	0.353	0.001	0.971 ns	1.013
Residence time	0.023	0.338	0.004	0.947 ns	1.023
Source of income	0.194	0.091	4.572	<b>0.033*</b>	1.214
Participation in mangrove conservation training	18.954	5235.9	0	0.997 ns	170385159
Awareness on mangrove governing laws	1.497	0.425	12.414	<b>0*</b>	4.468
Participation in communal activities	0.120	0.430	0.078	0.780 ns	1.128
Land ownership	-0.488	0.542	0.810	0.368 ns	0.614
Constant (intercept)	-3.098	1.418	4.773	<b>0.029*</b>	0.045
Chi-square = 59.819	df = 10			Nagelkerke R square = 0.344	
-log likelihood = 164.289	Overall percentage correctness = 89				Valid n = 300

$\beta$  = Coefficient of regression, + and - are positive and negative relations respectively, *p* value = Significance level, SE is the standard error, \* represents statistically significant at  $p < 0.05$ , ns = indicates statistically non-significant at  $p < 0.05$ . Wald value determines statistical significance of the independent variables.

mangroves. The high level of participation was credited to the potential for mangrove ecotourism as well as the support of government and private stakeholders to enable community-based management.

Local community participation is however contingent on incentives and benefits they will receive. Lack of benefits discourages local communities from participating in conservation initiatives (Paudyal *et al.*, 2018; Valenzuela *et al.*, 2020). Conservation activities should ensure socio-economic and socio-cultural wellbeing of local communities which are essential for maintaining conservation development (Gumede and Nzama, 2021). However, Kangalawe and Masao (2018) reported a number of challenges facing effective community engagement in conservation initiatives in the delta including little trust between community and government officers, and poor knowledge on the importance of conservation among communities. In other areas, similar and additional challenges have also been reported including political influence, inadequate capacity, time and desire to maintain natural resource management (Kangalawe, 2012; Abdullah *et al.*, 2014; Gumede and Nzama, 2021). The National Forest Policy of 1998, National Forest Policy Implementation Strategy of 2018-2028 and the Forest Act of 2002 emphasize community participation in mangrove conservation through implementation of PFM approaches (JFM and CBFM) (Zahabu *et al.*, 2009; Mshale *et al.*, 2017). In 2013, The Ministry of Natural Resources and Tourism through the forest sector developed specific

guidelines for benefit sharing mechanisms under JFM which offer a framework for outlining roles and the associated community benefits (Mshale *et al.*, 2017). However, the problem has been on implementation of the guidelines. JFM, not only in mangroves, but also in other productive state forest reserves has remained relatively ineffective and limited to written guidelines. This is because there is no clear binding agreements on how forest benefits and revenues are shared equally between government and local communities (Nurse and Kabamba, 2001; MNRT, 2008). Substantial evidence from wildlife management programmes and other participatory forest management cases in Tanzania indicate that revenue sharing at the community level is still uneven (Melita and Mendlinger, 2013; Carius and Job, 2019; Harris *et al.*, 2020). An impact evaluation report by Persha and Meshack (2016) stated that JFM in Tanzania has enabled raising the level of local level governance, particularly through the function of VNRCs, but lacked in improving livelihoods of local communities participating in JFM which necessitates questioning the long-term sustainability of the strategy at the local level.

Understanding the need and importance of conservation triggers local communities to take part as partners in conservation programmes. Findings of this study are in line with observations that willingness of the local community to participate in conservation of natural resources is shaped by a mixture of drivers that are both demographic and behavioural (Ward *et al.*, 2017; Htay *et*

*al.*, 2022), including age of household head, education level, source of income and personal knowledge on mangrove governing laws. In this study, age of household head was statistically significant and positively correlated with community willingness to participate in conservation, implying that old people were more willing to participate in conservation than young ones. This might be due to the fact that young individuals do not value conservation activities and see this as a waste of time. Overall, the majority of respondents were in the age group 18-45 which is the most productive age to engage in livelihood activities for household income generation. Also, young people are high mobile and frequently move to towns in quest of employment and other opportunities (Garekae *et al.*, 2017). A feeling of respect, absence of jobs and an expectation to get even small monetary benefits from conservation activities might influence old people to participate in conservation. However, old people have long-term experience of the negative consequences of mangrove degradation and understand their surrounding environment well, therefore being willingly to protect their environment. The findings contradict articulations of Mogo-motsi *et al.* (2020) who reported that older respondents were less likely to participate in wildlife conservation in the Okavango Delta in Botswana and recommended the provision of conservation education especially to young people who can influence the elderly. Kirupakaran and Thiruchelvam (2010) reported that old people were unwilling to participate in conservation of freshwater turtles in Sri Lanka because they will not live long enough to enjoy the benefits of preserving resources in later years. Furthermore, observations by Mpokigwa *et al.* (2011) and Hassan (2015) indicated that older people are unwilling to participate in environmental natural resource conservation because they are less sensitive and concerned about environmental conditions compared to young people.

Level of education was statistically significant with a positive regression coefficient, implying higher educated respondents were more willing to participate in conservation than lower educated individuals. Educated people understood the importance of mangrove conservation to their livelihoods and environment and were therefore able to positively participate in conservation. Ponrahono and Sunoto (2019) reported a similar observation that education level positively influences community willingness to participate in mangrove conservation in Malaysia. In other cases of natural resource conservation (Kirupakaran and Thiruchelvam, 2010) higher levels of education is a

determinant of coastal community willingness to participate in conservation of freshwater turtles in Sri Lanka. People with higher education would likely have better awareness of environmental issues which may result in a higher willingness to participate (Grazhdani, 2014; Xue *et al.*, 2022). Likewise, source of income was statistically significant with a positive regression coefficient indicating that people whose major sources of income are mangrove-based were more likely to participate in conservation to enable them to air their views and attitudes to conservationists regarding different laws and regulations that affect their access to utilize mangrove areas or related resources. This finding corroborates observations by Sesabo *et al.* (2006) who claimed that poor households who are dependent on common and open resources are highly motivated to support establishment and conservation of marine protected areas in Tanzania. Astuti *et al.* (2017) reported farmers are more participative in mangrove conservation due to their day-to-day interactions in the field as compared to non-farmers. Conversely, Mwanyoka (2006) claimed that people whose income depended on environmental resources are less likely to support conservation initiatives with the feeling that conservation initiatives might hinder their income-generating activities. Similarly, awareness of mangrove governing laws was statistically significant and positively influenced community willingness. The majority of respondents indicated that they know and understand the laws governing mangroves in their areas following awareness raising programmes initiated by respective authorities (TFS, VNRCs). Several studies by Sesabo *et al.* (2006), Mpokigwa *et al.* (2011) and Macharia (2015) have reported that an increase in public awareness on the existence of rules governing the use of coastal resources increases community willingness in forestry conservation interventions.

Other variables did not statistically influence community willingness to participate. Positive regression coefficient on gender implied more men are willing to participate than women. Sterian and Soutsas (2005) and Garekae *et al.* (2017) reported that men have more positive attitudes and are ready to participate in forestry conservation activities than women. According to coastal traditions, men are heads of household and play the major role in household decision making (Mshale *et al.*, 2017; Nyangoko *et al.*, 2021). Women are obliged to take care of house chores while men go out to search for income. This tradition has supported views that women are inferior and the exclusion of women in important village matters including

participation in conservation initiatives. Several studies (Mpokigwa *et al.* 2011; Hassan, 2015; Garekae *et al.*, 2017; Ponrahono and Sunoto, 2019) have indicated that an increase in the residence time in the area influences community willingness to participate in conservation, in agreement with the findings of this study. The majority of respondents indicated that they had been living in the delta for 21-40 years. Longer staying residents are more familiar with their environment and keen to engage in conservation efforts (Nyangoko *et al.*, 2022). Household size was also positively related with community willingness to participate in conservation. This implies that larger households are more willing to participate than small households. In large households, there is the possibility of division of labour among household members. This creates opportunity for some members to attend conservation activities while others participate in production activities. Larger households have increased demands for basic necessities which increases their mangrove dependency (Nyangoko *et al.*, 2022), hence triggering their participation. Suggestions by Kirupakaran and Thiruchelvam (2010) and Garekae *et al.* (2017) that larger household are more likely to participate and support conservation programmes, are in agreement with findings from this study.

Participation in mangrove conservation training and communal activities were positively related to community willingness to participate in mangrove conservation activities. Respondents who regularly participate in trainings and communal activities agreed to willingly participate in conservation activities. The findings indicated that over 60 % have voluntarily participated in communal activities including construction of government buildings (dispensaries, schools) and village infrastructure for their village development. Responsible government authorities and conservation stakeholders should support more trainings programmes to raise community awareness. Macharia (2015) who researched in Meru County in Kenya found that the majority of respondents who have attended various trainings and workshops on mangrove conservation have awareness that contributed to effective participation in implementing forest conservation projects. In this study, land ownership did not positively relate to community willingness to participate in conservation activities, implying that regardless of the amount of farmland owned, many households were willing to participate in conservation. The findings indicated that the majority of respondents in the delta owned 1-3 acres of farmland within the mangrove area

outside their villages. The negative regression coefficient implies that as the number of people who own farmland in mangroves increases, their willingness to participate decreases. Since 2010 the government has actively restricted rice farm expansion in the delta through conservation laws and regulations (Mshale *et al.*, 2017). Respondents might have been reluctant to support mangrove conservation activities thinking that this might increase their chances of being evicted from mangrove areas. Mogomotsi *et al.* (2020) found that people owning ploughing fields within wildlife conservation areas were less likely to participate in conservation in the Okavango Delta in Botswana. In contrast, Mndolwa *et al.* (2009) who carried out research in terrestrial community-based forests in Tanzania found that high participation of people in forest management was enhanced by the fact that many owned forest land.

## Conclusions

This study set out to evaluate local community willingness to participate in mangrove conservation activities in the Rufiji Delta. It was found that in general local communities have knowledge of the importance of their participation in conservation activities towards sustainable use of natural resources. The majority disclosed moderate levels of willingness. Mangrove restoration activities were rated as highly important by the majority (over 85 %) of respondents. Age of household head, education level, source of income and awareness on mangrove governing laws are significant factors and were positively associated with community willingness to participate. Altogether, these findings suggest that for effective conservation, it is important for responsible conservation authorities to recognize and include locals in conservation activities. The government should strengthen implementation of participatory forest management approaches as emphasized by the National Forest Policy of 1998, National Forest Policy Implementation strategy of 2018-2028 and Forest Act of 2002. This can be supported by reviewing how benefits for communities can be generated and shared equally, capacity building of local level institutions such as VNRCs, and improving TFS capacity with human, technical and financial resources to enhance community forest management mechanisms. Communities would be willing to engage in conservation if their position is adequately recognized and they are given the opportunity to exercise their mandate. This can be achieved by engaging locals in planning and decision-making and implementation of laws and regulations governing their own areas. Local communities should be provided with incentives to encourage



them to develop the capacity and desire to sustainably manage conservation programmes such as payment to mangrove planters, donation of livestock to poor households, giving rewards to illegal use reporters, revenue sharing, establishment of local mangrove protection teams and supporting trainings.

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## References

- Abdullah K, Said AK, Omar D (2014) Community-based conservation in managing mangrove rehabilitation in Perak and Selangor. *Procedia - Social and Behavioural Sciences* 153 :121-131
- Angelsen A, Larsen HO, Lund JF, Smith-Hall C, Wunder S (2011) Measuring livelihoods; Methods for research and fieldwork; Bogor, Indonesia. CIFOR. 227 pp
- Astuti S, Muryani C, Rindarjono MG (2018) The community participation on mangrove conservation in Sayung, Demak from 2004-2016. *IOP Conference Series: Earth and Environmental Science* 145: 012087
- Aye WN, Wen Y, Marin K, Thapa S, Tun AW (2019) Contribution of mangrove forests to the livelihoods of local communities in Ayeyarwaddy Region, Myanmar. *Journal of Forests* 10 (414): 1-13
- Biswal T (2006) Human rights, gender and environment. Viva Books Private Limited, New Delhi, India 508 pp
- Biswas P, Biswas SR (2019) Mangrove forests: Ecology, management, and threats. In: Filho WL, Azul AM, Brandli L, Salvia AL (eds) *Life on land: Encyclopedia of the UN Sustainable Development Goals*, Springer Nature, Switzerland. pp 1-14 [[https://doi.org/10.1007/978-3-319-71065-5\\_26-1](https://doi.org/10.1007/978-3-319-71065-5_26-1)]
- Carius F, Job H (2019) Community involvement and tourism revenue sharing as contributing factors to the UN Sustainable Development Goals in Jozani-Chwaka Bay National Park and Biosphere Reserve, Zanzibar. *Journal of Sustainable Tourism* 27 (6): 826-846
- Erfemeijer P, de Boer M, Hilarides L (2022) Status of mangroves in the Western Indian Ocean region. *Wetlands International* (July). 67 pp
- Ellison JC (2012) Climate change vulnerability assessment and adaptation planning for mangrove systems. World Wildlife Fund (WWF), Washington, DC. 130 pp
- Gallup L, Sonnenfeld DA, Dahdouh-Guebas F (2020) Mangrove use and management within the Sine-Saloum Delta, Senegal. *Journal of Ocean and Coastal Management*: 185
- Garekae H, Thakadu OT, Lepetu J (2017) Socio-economic factors influencing household forest dependency in Chobe enclave, Botswana. *Journal of Ecological Processes* 6: 1-40
- Goldberg L, Lagomasino D, Thomas N, Fatoyinbo T (2020) Global declines in human-driven mangrove loss. *Journal of Global Change Biology* 26 (10): 5844-5855 [<https://doi.org/10.1111/gcb.15275>]
- Gumede TK, Nzama AT (2021) Approaches toward community participation enhancement in ecotourism. In: Suratman MN (ed) *Protected area management - Recent advances*. Intech Open. pp 1-22 [<https://doi.org/10.5772/intechopen.100295>]
- Grazhdani D (2014) Estimating residents' willing to pay using contingent valuation for ecological restoration and recreational benefits of AL-Prespa protected area in Albania. *Journal of Food Agricultural Environment* 12: 365-370
- Harris WS, de Kort SR, Bettridge CM, Borges J, Cain B, Dulle HI, Fyumagwa R, Gadiye D, Jones M, Kahana L, Kibebe J, Kideghesho JR, Kimario FF, Kisingo A, Makari F, Martin E, Martin A, Masuruli MB, Melubo K, Mossman NL, Munishi L, Mwaya R, Nasi R, Nyakunga O, Price E, Shoo RA, Strange EF, Symeonakis E, Fa JA (2020) A learning network approach to resolve conservation challenges in the Ngorongoro Conservation Area. *African Journal of Ecology* 59: 326-331
- Hassan A (2015) Assessment of community's Participation in conservation of open spaces in Dar es Salaam City, Tanzania. MSc Thesis, Sokoine University of Agriculture. 63 pp
- Htay T, Htoo KK, Mbise FP, Røskaft, E (2022) Factors influencing communities' attitudes and participation in protected area conservation: A case study from Northern Myanmar. *Society & Natural Resources* 35 (3): 301-319 [<https://doi.org/10.1080/08941920.2022.2032515>]
- Japhet E (2018) The status of ecological resources in the Rufiji Delta, Tanzania. Report to Wetlands International East Africa, Tanzania Project Office. 46 pp
- Japhet E, Mangora MM, Trettin CC, Okello JA (2019) Natural recovery of mangroves in abandoned rice farming areas of the Rufiji Delta, Tanzania. *Western Indian Ocean Journal of Marine Sciences* 18 (2): 25-36



- Kajembe GC, Nduwamungu J, Luoga EJ (2006) The impact of community-based forest management and joint forest management on the forest resource base and local people's livelihoods: Case studies from Tanzania. *Commons Southern Africa Occasional Paper Series 8*. 23 pp
- Kangalawe RYM (2012) Land degradation, community perceptions and environmental management implications in the drylands of Central Tanzania. In: Curcovic S (ed) *Sustainable development – Authoritative and leading edge content for environmental management*. Intech Open. pp 540-560 [<http://dx.doi.org/10.5772/45897>]
- Kangalawe RYM, Masao CA (2018) Mangrove capital Africa Rufiji Delta livelihoods baseline study. Contract No. TZ/MZA/002. Draft report to Wetlands International, Africa. 67 pp
- Kariuki KJ (2014) Factors influencing community participation in project planning in Kenya. A base study of Mbucana Water Dam Project, Kiambu County. *Journal of Business and Change Management* 2 (29): 561-582
- Kilemo DB, Kikoti IA, Saidia MK, Rusule D (2014) The performance of community based forest management in Tanzania: The case of selected villages in Morogoro District. *Journal of Biological Sciences* 6 (2): 60-65
- Kirupakaran S, Thiruchelvam S (2010) Coastal communities' attitudes towards conservation of freshwater turtle in Ampara District. *Journal of Tropical Agricultural Research* 21 (4): 427-434
- Krueger RA, Casey MA (2009) *Focus groups: A practical guide for applied research*, 4<sup>th</sup> ed. SAGE Publications, Los Angeles. 219 pp
- Longopa EE (2013) Policy, legal and institutional framework for natural resources management. MCA baseline study report for Wetlands International Africa: Dakar, Senegal. 41 pp
- Macharia BW (2015) Factors influencing community participation in forestry conservation projects: A case of Kithoka-Twajai forest community based organization, Meru County, Kenya. MSc Report, University of Nairobi. 52 pp
- Mangora MM, Trettin CC, Shalli MS (2016) Mangrove research and training forest Rufiji Delta, Tanzania. East Africa Mangrove Carbon Project Progress Report for USAID Africa Bureau and Tanzania Forest Service Agency. 35 pp
- Melita A, Mendlinger S (2013) The impact of tourism revenue on the local communities' livelihood: A case study of Ngorongoro Conservation Area, Tanzania. *Journal of Service Science and Management* 6 (1):117-126 [<https://doi.org/10.4236/jssm.2013.61012>]
- Mndolwa M, Japhet E, Mauya E (2009) Effectiveness of governance on community based forest management approach in Iringa District at Morogoro 2008 – 2009. In: Nshubemuki L, Chamshama SAO, Mbwambo L, Balama, C, (eds.). *Proceedings of the first participatory forestry management research workshop, Morogoro, Tanzania*. pp 147 – 158
- MNRT (2008) *Participatory forest management in Tanzania facts and figures*. 13 pp
- Mogomotsi PK, Stone, LS, Mogomotsi GEJ, Dube N (2020) Factors influencing community participation in wildlife conservation. *Journal of Human Dimensions of Wildlife* 25 (4): 372-386
- Monga E, Mangora MM, Mayunga JS (2018) Mangrove cover change detection in the Rufiji Delta in Tanzania. *Western Indian Ocean Journal of Marine Science* 17 (2): 1–10 [<https://doi.org/10.4314/wiojms.v17i2.1>]
- Mpokigwa MK, Sangeda AZ, Iddi S (2011) Toward communication, education and awareness raising for participatory forest management: A case study of Mufindi district, Tanzania. *Journal of Social Forestry* 4 (1): 17-31
- Mshale B (2017) *Governing mangroves. Unique challenges for managing Tanzania's coastal forests*. CIFOR, Bogor, Indonesia; USAID Tenure and Global Climate Change Programme, Washington DC. 62 pp
- Mwansasu S (2016) Causes and perceptions of environmental change in the mangroves of Rufiji Delta, Tanzania: Implications for sustainable livelihood and conservation. PhD Thesis, Stockholm University. Stockholm, Sweden. 43 pp
- Mwanyoka IR (2006) Evaluation of community participation in water resources management: The case of the East Usambara Biosphere Reserve Tanzania. Research report submitted to UNESCO MAB young scientists programme. 43 pp
- Ndesanjo R, Ngana JO, Yanda PZ (2012) Climate change impact and adaptive strategies in the Rufiji Delta, Tanzania. *Journal of Utafiti* 9 (1, 2): 59–73 [<https://www.researchgate.net/publication/316683995>]
- Ntibona LN, Shalli MS, Mangora MM (2022) Incentives and disincentives of mangrove conservation on local livelihoods in the Rufiji Delta, Tanzania. *Journal of Trees, Forests and People* 10: 0100326 [<https://doi.org/10.1016/j.tfp.2022.100326>]
- Nurse M, Kabamba J (2001) Defining institutions for collaborative mangrove management: A case study from Tanga, Tanzania. *Forest and social perspectives in conservation working paper No. 01: IUCN, Eastern Africa Programme*. 16 pp

- Nyangoko BP, Berg H, Mangora, MM, Gullström M, Shalli MS (2021) Community perceptions of mangrove ecosystem services and their determinants in the Rufiji Delta, Tanzania. *Journal of Sustainability* 13 (1): 1-23 [https://dx.doi.org/10.3390/sul3010063]
- Nyangoko BP, Shalli MS, Mangora MM, Gullstrom M, Berg H (2022b) Socioeconomic determinants of mangrove exploitation and management in the Pangani River Estuary, Tanzania, *Journal of Ecology and Society* 27 (2): 32 [https://dx.doi.org/10.5751/ES-13227-270232]
- Paudyal R, Thapa B, Neupane S, Kc B (2018) Factors associated with conservation participation by local communities in Gaurishankar Conservation Area Project, Nepal. *Journal of Sustainability* 10: 3488
- Persha L, Meshack C (2016) A triple win? The impact of Tanzania's Joint Forest Management Programme on livelihoods, governance and forests, *3ie* Impact Evaluation Report 34. International Evaluation for Impact Evaluation (*3ie*), New Delhi. 82 pp
- Ponrahono Z, Sunoto YN (2019) Willingness to participate and current participation level in mangrove conservation. The European proceedings of social and behavioural sciences, Asia international multidisciplinary conference. 11 pp [https://doi.org/10.15405/epsbs.2019.05.02.41]
- Romanach SS, DeAngelis DL, Koh HL, Li Y, The SY, Sulaiman R, Barizan R, Zhai R (2018) Conservation and restoration of mangroves: Global status, perspectives and prognosis. *Journal of Ocean and Coastal Management* 154: 72-82
- Richmond MD, Wilson JDK, Mgaya YD, Le Vay L (2002) An analysis of smallholder opportunities in fisheries, coastal and related enterprises in the floodplain and delta areas of the Rufiji River, Tanzania: Environmental management and biodiversity conservation of forests, woodlands, and wetlands of the Rufiji Delta and Floodplain. Rufiji Environment Management Project – REMP. Technical report 2. 89 pp
- Semesi AK (1992) The mangrove resources of the Rufiji Delta, Tanzania. In: Matiza T, Chabwela HN (eds) Wetlands conservation conference proceedings of the Southern Africa Development Coordination held in Gaborone, Botswana. pp 157-172
- Sesabo JK, Lang H, Tol RSJ (2006) Perceived attitude and Marine Protected Areas (MPAs) establishment: Why households' characteristics matters in coastal resources conservation initiatives in Tanzania. Working Paper FNU-99. 39 pp
- Schoonenboom J, Johnson RB (2017) How to construct a mixed methods research design. *Journal of Kolner ZSoziol. Sozialpsychol* 69: 107-131 [https://doi.org/10.1007/s11577-017-0454-1]
- Shannon SE, Hsieh H (2014) Three approaches to qualitative content analysis. *Journal of Qualitative Health Research* 15 (9): 1277-1288 [https://doi.org/10.1177/1049732305276687]
- Spalding MD, Leal M (eds) (2021) The state of the world's mangroves 2021. Global Mangrove Alliance. 78 pp
- Sperandei S (2014) Understanding logistic regression analysis. *Journal of Biochemia Medica* 24 (1): 12-18 [https://doi.org/10.11613/BM.2014.003]
- Sterian MK, Soustas KP (2005) Recreation demand model construction through the use of regression analysis with optimal scaling. *Journal of New Medit* 4: 25-30
- Thuy PT, Vu TP, Pham DC, Dao LHT, Nguyen VT, Hoang NVH, Hoang TL, Dao TLC, Nguyen DT (2019) Opportunities and challenges for mangrove management in Vietnam: Lessons learned from Thai Binh, Quang Ninh and Thanh Hoa provinces. Occasional Paper 197. CIFOR, Bogor, Indonesia. 55 pp
- UNEP (2014) The importance of mangroves to people: A call to action. In: van Bochove JE, Sullivan T, Nakamura (eds). United Nations Environment Programme, World Conservation Monitoring Centre, Cambridge, UK. 128 pp
- URT (2020) Rufiji Delta mangrove forest reserve management plan. 100 pp
- Valenzuela RB, Yeo-Chang Y, Park MS, Chun J (2020) Local people's participation in mangrove restoration projects and impacts on social capital and livelihood: A case study in the Philippines. *Journal of Forests* 11: 580 [https://doi.org/10.3390/fl1050580]
- Ward C, Holmes G, Stringer L (2017) Perceived barriers to and drivers of community participation in protected-area governance. *Journal of Conservation Biology* 32 (2): 437-446 [https://doi.org/10.1111/cobi.13000]
- Xu L, Xu W, Jiang C, Dai H, Sun Q, Chen K, Lee CH, Zong C, Ma J (2022) Evaluating communities' willingness to participate in ecosystem conservation in South-east Tibetan nature reserves, China. *Journal of Land* 11 (2): 1-18 [https://doi.org/10.3390/land11020207]
- Zahabu E, Eid T, Kajembe GC, Mbwambo L, Mongo C, Sangeda AZ, Malimbwi RE, Katani JZ, Kashaigili JJ, Luoga EJ (2009) Forestland tenure systems in Tanzania: an overview of policy changes in relation to forest management. *INA fagrapport* 14. 24 pp