frontiers in Sustainable Tourism

TYPE Original Research
PUBLISHED 09 March 2026
DOI 10.3389/frsut.2026.1740699

OPEN ACCESS

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RECEIVED 06 November 2025
REVISED 11 February 2026
ACCEPTED 16 February 2026
PUBLISHED 09 March 2026

CITATION
Kulunge SR, Mariki S, Kitegile A, Snyman SS, Sibanda L, Dickman A, Hare D and Mbije N (2026) Community perspectives on wildlife-based tourism benefits at three wildlife management areas in northern Tanzania.
Front. Sustain. Tour. 5:1740699.
doi: 10.3389/frsut.2026.1740699

Community perspectives on wildlife-based tourism benefits at three wildlife management areas in northern Tanzania

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Introduction: Wildlife-based tourism (WBT) is a vital strategy for integrating biodiversity conservation with rural development in Tanzania's Wildlife Management Areas (WMAs). Although wildlife-related policies emphasize equitable benefit-sharing between conservation stakeholders and rural communities, there is limited empirical evidence on how these benefits are perceived by residents living within WMAs. Guided by social exchange theory (SET), this study posits that long-term community support for conservation depends on perceived fairness and relevance of WBT benefits. Understanding local perceptions of WBT benefits may be essential for shaping policy, such as determining which household-level benefits are acceptable and to whom, thereby ensuring long-term support for and the success of conservation efforts.

Methods: This study examined community perceptions of WBT benefits across three WMAs in northern Tanzania: Burunge, Enduimet, and Randilen. We administered 548 questionnaires and 20 key informant interviews. We assessed perceptions of different WBT benefits across four domains: employment, scholarships, capacity building and social services, including livelihood support. Using ordinal logistic regression, we examined how various socio-demographic variables predict perceived benefits and conducted a thematic analysis to contextualize the qualitative findings.

Results: While most respondents acknowledged some socioeconomic benefits from WBT, particularly in capacity building (70.0–87.3%) and access to social services and livelihood support (65.4–77.5%), these benefits were widely viewed as limited in both scope and impact. Employment emerged as the least perceived benefit (32.1–36.5%). Respondents' level of formal education, age, length of residence, and the WMA where they live explained perceived benefits from WBT.

Conclusion: Community perceptions are context-specific and tied to lived local experience. This emphasizes the need for designing context-specific benefit-sharing strategies that are inclusive, equitable and responsive to the diverse socio-economic needs of households within WMAs. Future WBT interventions should prioritize ensuring that rural communities receive the actual benefits and bridge the perceptual gap among residents with lower levels of formal education and those who are relatively new to the area, as these groups

consistently reported lower recognition of WBT-related benefits. By tailoring engagement strategies and acknowledging socio-spatial diversity, WBT can better align benefits with community needs, enhance local support, and ensure the long-term success of conservation efforts.

KEYWORDS

benefit-sharing, conservation, livelihoods, local communities, revenue, wildlife resources

1 Introduction

Wildlife-based tourism (WBT) is widely regarded as a promising strategy for supporting both social and economic development and biodiversity conservation, particularly in rural areas with high tourism potential (Snyman and Bricker, 2019; Akayezu et al., 2022; Mmbaga et al., 2024). It typically involves tourists traveling to natural habitats primarily to observe, experience, or interact with wild animals in their natural environment (Macdonald and Wester, 2021; Rizzolo, 2023). When effectively managed, WBT can generate a range of benefits, including employment, capacity building, and improved social services and livelihood support, which may contribute to socioeconomic development and conservation objectives (Ngowi and Jani, 2018; Akayezu et al., 2022; Mmbaga et al., 2024). However, the long-term success of WBT initiatives depends not only on their ecological and economic returns, but also on the perceived benefit distributions among local stakeholders (Kegamba et al., 2022; Parker et al., 2022).

Perceived benefits refer to the advantages that people believe they have gained from WBT initiatives, shaped by their personal experiences, expectations and interpretations of outcomes (Bennett, 2016; Ntuli et al., 2019). WBT often yields mixed outcomes. While some communities report tangible benefits from WBT revenues and partnerships, others feel excluded, marginalized or unfairly burdened by the associated costs of conservation (Mariki et al., 2015; Minja et al., 2023). These costs may include land-use restrictions, limited access to natural resources, and increased human-wildlife conflicts, such as crop damage, livestock depredation and in some cases, human injuries, fatalities and emotional distress (Barua et al., 2013; Mbise and Røskaft, 2021; Raycraft, 2023). When benefits are perceived as inequitable or insufficient, local support for conservation efforts tends to diminish, ultimately undermining both socio-economic development and biodiversity conservation (Mbeche, 2022; Mgonja, 2023).

This issue is particularly salient in Tanzania, where approximately one-third of the country (307,800 km^2) is designated as Protected and Conserved Areas (PCAs), including national parks, game reserves, conservation areas and nature reserves. These areas provide key habitats for wildlife while also significantly influencing the livelihoods of neighboring communities (IUCN-ESARO, 2020). In addition to core PCAs, there is a network of Wildlife Management Areas (WMAs), such as Burunge, Randilen, and Enduimet WMAs, which play an important role in WBT and conservation. According to the United Republic of Tanzania [United Republic of Tanzania (URT), 2018], WMAs were established in the mid-2000s as part of national conservation policy reforms, to promote participatory conservation by empowering village coalitions, organized as Authorized Associations, to collectively manage, benefit from and sustainably utilize wildlife resources outside national parks and game reserves. Through WBT ventures and related activities, WMAs have the potential to generate employment, improve social services, stimulate local economic growth and support conservation objectives (Lwankomezi et al., 2021; Kegamba et al., 2022; Mgonja and Uswege, 2022). However, when poorly managed, WBT may lead to habitat degradation, disrupt wildlife populations, marginalize local communities and erode cultural values (Mariki, 2016; Moyo et al., 2017; Parker et al., 2022; Kyara et al., 2022).

Central to the success and sustainability of WMAs and other conservation models is the manner in which benefits are shared with local communities (Kegamba et al., 2022, 2023; Snyman et al., 2023). Benefit-sharing in WBT involves returning a portion of monetary or non-monetary benefits to stakeholders, especially local communities and conservation partners such as government agencies, non-governmental organizations and private sector actors, derived from both consumptive and non-consumptive tourism (Snyman and Bricker, 2019). In Tanzania, most communities near PCAs receive some form of benefits from conservation initiatives (Kegamba et al., 2022, 2023). For example, the Tanzania National Parks Authority allocates 7.5% of its annual budget to support social services (Kaaya and Chapman, 2017), while the Tanzania Wildlife Management Authority returns 25% of trophy hunting revenues to districts where hunting has taken place to support basic public services (TAWIRI, 2024).

By law, WMAs are required to redistribute WBT revenues directly to their member villages. According to United Republic of Tanzania (URT) (2018) regulations, at least 50% of gross annual tourism revenue should be allocated to member villages, and 60% of WBT-related employment should be reserved for residents. Additionally, WBT operators are encouraged to contribute to local development by supporting community-based enterprises, such as guiding, craft sales and local accommodation initiatives (Shoo et al., 2021; Mmbaga et al., 2024). They are also expected to fund basic social services, including healthcare, access to clean water and road infrastructure, and to invest in capacity building through skills training and targeted support for women's and youth groups engaged in income-generating activities or leadership roles (Kegamba et al., 2022, 2023; Lugalla et al., 2024).

Despite these policy ambitions, benefit-sharing remains a persistent and contested issue. Previous studies have identified several challenges affecting the distribution of WBT benefits (Mariki 2016; Moyo et al., 2017; Sulle and Banka, 2017; Kicheleri et al., 2021; Snyman et al., 2023). These include: (i) insufficient revenue to support livelihoods or offset the costs of living near

wildlife areas, including ongoing human-wildlife conflicts; (ii) limited visibility of WBT benefits, as communities often do not associate infrastructure improvements like roads or schools with tourism revenues; and (iii) regulatory barriers that hinder equitable benefit-sharing among WMA member villages. Furthermore, regulations often prohibit community access to non-timber forest products such as thatch grass, honey and firewood, which further limits the perceived value of conservation efforts (Keane et al., 2019). Together, these structural and perceptual challenges have led to widespread community dissatisfaction, reduced engagement and sometimes conflicts among participating villages (Bluwstein et al., 2016; Marks et al., 2018; Kicheleri et al., 2021).

While previous research has explored the WBT benefits within WMAs, much of it has focused on individual sites or broad comparisons between conservation models, leaving a knowledge gap in understanding how rural communities perceive the benefits they receive (Lwankomezi et al., 2021; Kegamba et al., 2023; Mmbaga et al., 2024). Grounded in the Social Exchange Theory (SET), this study assumes that perceived benefits, whether present or lacking, are central to how communities evaluate and engage with initiatives such as WBT (Odinga, 2022; Jani, 2018). This is particularly relevant in WMAs, where socio-economic inequalities may affect both participation and distribution of benefits. However, most existing research treats communities as homogenous units or focuses on a single WMA, overlooking demographic variables such as age, sex and education as well as contextual factors such as length of residence and the specific WMA in which individuals live. As a result, policy assumptions about equitable benefit-sharing are often based on overly simplified understandings that do not fully reflect the diversity of local experiences and needs. Recognizing this variation is essential, as even perceptions of insufficient or inequitable benefit sharing can generate conflict, with consequences for both local livelihoods and conservation goals (Moyo et al., 2016; Bluwstein et al., 2016; Minja et al., 2023).

Thus, this study aims to explore how rural communities perceive the benefits of WBT in Burunge, Randilen, and Enduimet WMAs in northern Tanzania. Specifically, this study seeks to answer the following research questions: (i) How do rural communities perceive the benefits derived from WBT? (ii) How do perceptions of specific WBT benefit types (e.g., employment, scholarships, social services, capacity building) differ across WMAs? (iii) How do demographic (e.g., age, sex, education) and contextual factors (e.g., length of residence, WMA of residence) influence perceptions of WBT benefits? (iv) How do contextual factors (e.g., WMA) interact with demographic characteristics (e.g., age, education level, length of residence) and benefit types to shape community perceptions of WBT benefits?

2 Social exchange theory and community support for WBT

This study is grounded in SET, which provides a valuable framework for understanding how individuals and communities evaluate their support for WBT and conservation initiatives (Ngowi and Jani, 2018; Odinga, 2022). The SET posits that human behavior is shaped by rational evaluations of costs and benefits, where people are more likely to support initiatives when they perceive the outcome as fair, reciprocal and beneficial (Blau, 2017). The theory has been widely applied to explore factors influencing community attitudes toward tourism infrastructure, sustainable tourism and conservation-based enterprises (Nunkoo, 2016; Ngowi and Jani, 2018; Nazneen et al., 2019; Kattiyapornpong et al., 2021; Odinga, 2022; Ghaderi et al., 2022).

In the WBT context, SET helps explain why some communities embrace conservation efforts while others remain skeptical or resistant (Jani, 2018; Choudhary and Sharma, 2024). Support typically emerges when perceived benefits, such as employment, scholarships, capacity building and improved social services, outweigh costs, such as land use restrictions and human-wildlife conflicts (Kegamba et al., 2023; Hariohay et al., 2024).

From this framework, we identified four key themes through which communities experience and evaluate WBT benefits: (i) *Employment*; both permanent and temporary jobs with WBT operators and local businesses, including roles such as tour guides, traditional dance performances, and craft vendors. (ii) *Scholarships and educational support*; include support for low-income students to pursue higher education and assistance to schools through food and learning materials. (iii) *Social services and livelihood support*; comprises access to healthcare, public infrastructure, access to non-timber forest products, grazing areas, food aid, small loans, and health insurance to enhance household resilience. (iv) *Capacity building*: support to local groups through knowledge-sharing and training focused on entrepreneurship in hospitality, business management, establishment of community-run businesses (e.g., tours, handicrafts, and cultural experiences) and microcredit aimed at building skills for securing tourism-related jobs, improving livelihoods and promoting community participation.

However, the quantity of benefits alone does not guarantee positive perceptions (Ngowi and Jani, 2018), fairness and inclusion in benefits distribution are equally critical (Mgonja, 2023). Unequal or exclusionary sharing can foster feelings of exploitation and conflict, ultimately undermining both community welfare and conservation efforts (Minja et al., 2023). This aligns with SET's central premise that individuals' willingness to engage is driven by perceptions of benefits (Nazneen et al., 2019; Šegota et al., 2024).

Moreover, demographic and contextual factors, including age, sex, education, length of residence, and specific WMA, can shape how benefits are perceived and how different groups within communities engage in WBT. For example, younger residents and long-term inhabitants may have different expectations and levels of support toward WBT initiatives. Figure 1 presents a conceptual model illustrating how perceived WBT benefits could explain perceptions, which in turn drive engagement and support for conservation. Demographic and contextual factors further shape how these relationships unfold across Burunge, Randilen, and Enduimet WMAs.

3 Material and methods

3.1 Study area and context

We conducted this study in three WMAs in northern Tanzania: Burunge (283 km^2, 10 member villages); Randilen (312 km^2, 6

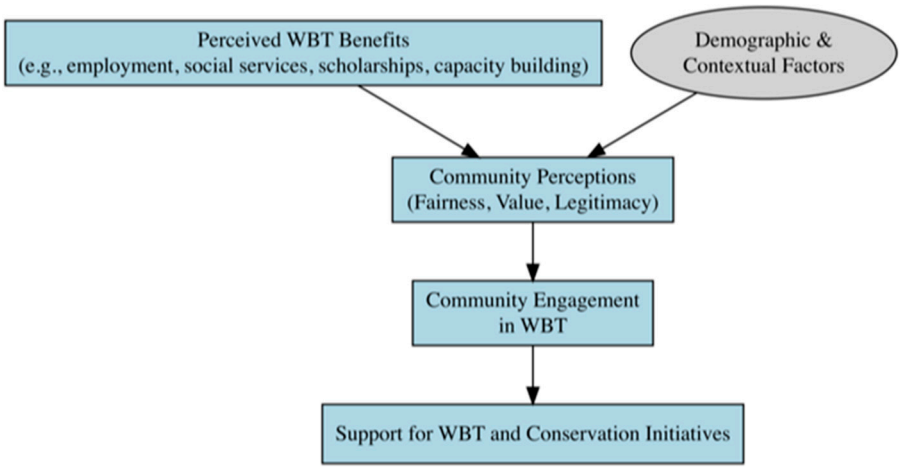

FIGURE 1
Conceptual framework based on Social Exchange theory (SET). Boxes show benefit perceptions influencing engagement and support for wildlife-based tourism; circles represent study variables shaping engagement in wildlife-based tourism.

member villages) and Enduimet (751 km^2, 9 member villages; Figure 2; Supplementary Table S1). These WMAs are characterized by semi-arid savanna vegetation within the *Acacia-Combretum* woodlands (Kiffner et al., 2020). Located in the country's most prominent region for WBT, known for rich biodiversity and scenic landscapes and drawing a substantial number of national and international tourists (Kideghesho et al., 2021).

Burunge WMA borders Lake Manyara and Tarangire National Parks, and Randilen WMA borders Tarangire National Park. Both WMAs are situated along the Kwakuchinja wildlife corridor, a wildlife-rich landscape that connects Tarangire and Lake Manyara National Parks. The corridor is renowned for its large herds of elephants and buffalo migrating between the parks, and is home to diverse populations of migratory waterbirds (Kiffner et al., 2015, 2020). Enduimet borders Kilimanjaro National Park in northern Tanzania and Amboseli National Park in southern Kenya. Enduimet WMA encompasses the Kitendeni wildlife corridor, which connects Kilimanjaro and Amboseli national parks and serves as an essential migratory route for elephants and other wildlife (Sanare et al., 2022).

Economically, Burunge and Randilen WMAs are among those generating substantial revenue from WBT and demonstrating high levels of financial independence (Sulle and Banka, 2017; Shoo et al., 2021). Enduimet, while still developing, holds significant potential for photographic and cultural tourism due to its abundant wildlife and rich Maasai cultural heritage (Kessy, 2017; Sanare et al., 2022). According to site managers from Burunge, Enduimet, and Randilen WMAs, tourism investment in these areas includes campsites, luxury tented camps, and photographic safaris, with trophy hunting occurring specifically in Enduimet. Burunge WMA is the most developed in terms of tourism infrastructure and visitations (Mmbaga et al., 2024). Burunge WMA hosts 11 tented camps, including some of the region's most luxurious accommodations, and receives over 20,000 visitors annually, including both overnight and day visitors (Burunge Site Manager, personal communication, January 2023). Randilen WMA hosts eight tented camps and attracts approximately 11,000 visitors annually (Randilen WMA site manager, Personal Communication, January 2023). In contrast, Enduimet WMA is comparatively less developed, with only three tented camps, and receives fewer than 4,000 tourists annually, including around 15 trophy hunters (Randilen WMA site manager, personal communication, 2023). Notably, trophy hunting is not practiced in Burunge or Randilen. In addition to these formal tourism enterprises, several villages participating in WMAs have established their own campsites, tourist lodges and Maasai cultural bomas (i.e., Maasai cultural tourism exhibitions; Kessy, 2017; Sulle and Banka, 2017). Community-based income-generating groups have also emerged, engaging in cultural activities, such as handicrafts and traditional dances (Shoo et al., 2021). Agro-pastoralism remains the primary livelihood strategy for most households, supplemented by WBT micro-enterprises that particularly aim to benefit women and youth (Mariki, 2016; Kicheleri et al., 2021).

3.2 Data collection

We employed a mixed-method approach, combining in-person household questionnaires and key informant interviews to collect data between November 2022 and January 2023. Household questionnaires captured quantitative information on demographic factors, socio-economic activities, and perceptions of WBT, while key informant interviews provided qualitative insights into benefit sharing and community experiences with WBT.

3.2.1 Sampling

We employed a two-stage sampling approach. First, we purposively selected three villages from each of the Burunge, Enduimet, and Randilen WMAs, resulting in a total of nine study villages. We chose villages based on their involvement in or exposure to WBT, primary livelihood activities (e.g., agriculture and agropastoralism) and proximity to WMA boundaries. We also

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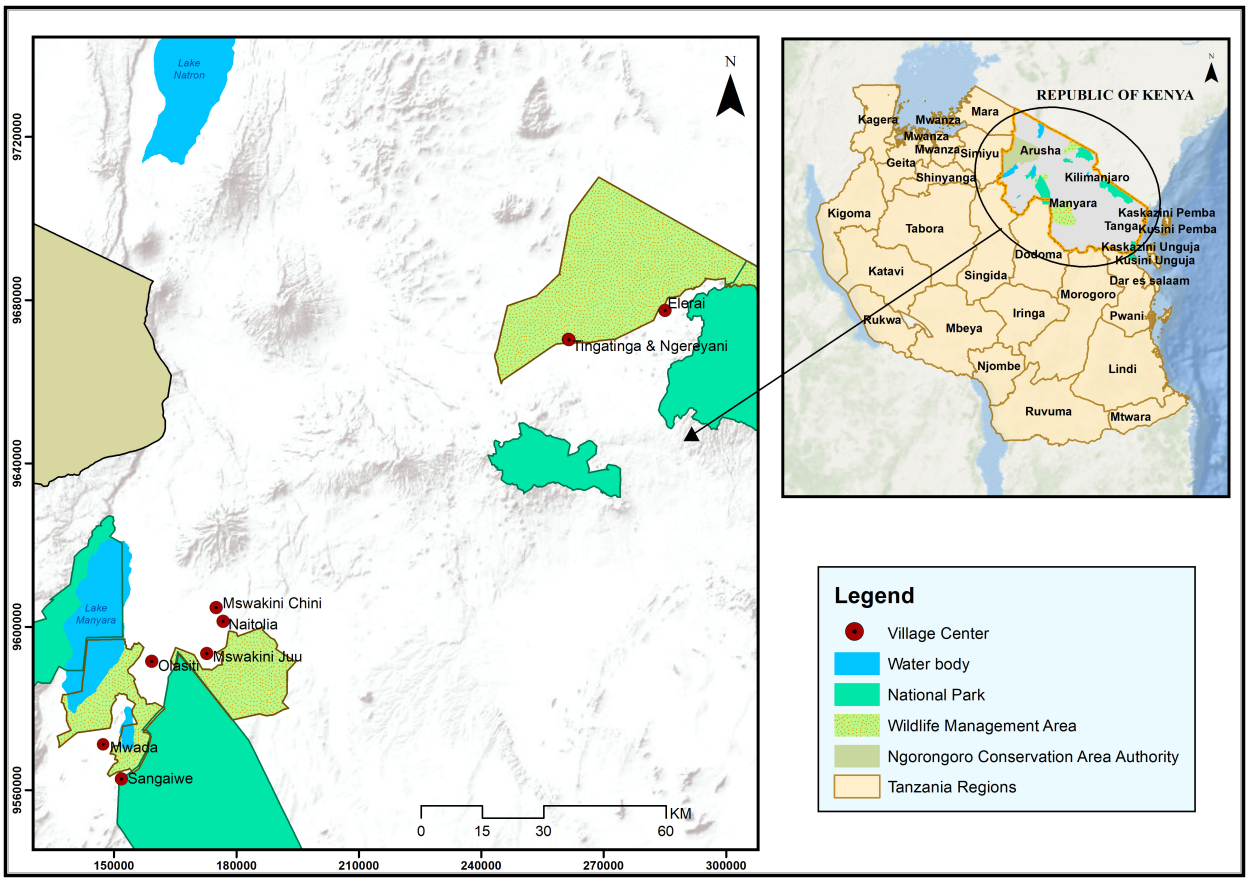

FIGURE 2
Location of study area, Burunge, Enduimet, and Randilen WMAs in the northern parts of Tanzania.

considered logistical factors, such as road accessibility, to facilitate fieldwork. We informed our selection using WMA records, previous literature and consultations with village leaders. The selected villages were Olasiti, Mwada, and Sangaiwe in Burunge; Mswakini chini, Mswakini juu, and Naitolia in Randilen; and Tingatinga, Ngereyani and Ildonyo in Enduimet.

Second, we systematically sampled households within each village. Starting at the village chairperson's household, we selected every 1st, 3rd, and 5th household from the village register to ensure broad spatial and social coverage. We invited all adult household members (aged 18 years or older) to participate if they consented (Kothari, 2019). Beginning at the village chairperson's household provided a trusted and transparent entry point, which helped us promote transparency and encourage community participation.

We purposively selected participants for key informant interviews based on their roles, experience and knowledge of WMA governance, WBT operations and community development. This approach ensured a range of perspectives across different stakeholder groups.

To ensure cultural awareness and minimize tensions during interviews, we employed six native speakers as research assistants. This is particularly important in WMAs and wildlife conservation research, because local people may have complex concerns about WBT and conservation. Two assistants visited one household at a time; each interviewing a household member separately and privately to minimize the influence of others and reduce the likelihood that respondents would coordinate their answers. Each household was assigned a unique Identification number, and enumerators read the questionnaire items and response options aloud, recording respondents' answers electronically using KoboCollect (www.humanitarianresponse.info). Before data collection, we obtained a research permit from the Tanzanian Commission for Science and Technology (COSTECH), Permit No. 2022-818-NA-2022-344, along with introductory letters from Babati, Monduli, and Longido districts.

3.2.2 Questionnaire

We administered the questionnaire to all adult household members aged 18 years or older, with an average of six respondents per household. This approach captured a broad range of individual perceptions across households and villages, ensuring diversity in age, sex, and lived experiences. We defined a household as a group of people living together and sharing income and expenses, though not necessarily residing in the same physical dwelling (Kothari, 2019). We obtained informed consent from all respondents, informing them of their right to withdraw at any stage and that any recorded material would be removed if they chose to do so, ensuring anonymity and voluntary participation. Respondents were

also assured that the research was independent and not affiliated with any donor agency or non-governmental organization. SET guided the framing of questions to capture perceived benefits, while insights from the literature informed the selection of specific benefit types such as employment, social services, livelihood support, relevant to rural communities (Nunkoo, 2016; Ngowi and Jani, 2018).

We developed the questionnaire in English and later translated it into Kiswahili to ensure clarity and consistency of survey responses. To ensure that the meaning of the questions was preserved during translation, we conducted a content validation test involving both forward and backwards translation (Hawkins, 2020). We pre-tested the questionnaire with 10 household members in Olasit village (Burunge WMA) to ensure clarity, and subsequently revised it based on feedback. Revisions included rephrasing questions, adjusting response options and reorganizing the questionnaire for better flow and coherence. Each questionnaire took approximately 20–30 min to complete.

We collected data from 548 respondents: 214 (39%) from Burunge WMA, 175 (32%) from Enduimet WMA and 159 (29%) from Randilen WMA. The questionnaire consisted of both binary (Yes/No) items and five-point Likert-scale questions designed to measure community perceptions of WBT-related benefits. For each benefit type, respondents were first asked whether the following groups of benefits were present in their community: employment, provision of social services (e.g., education, road repair, office building, and healthcare); and livelihood support, including support for small businesses, food assistance for impoverished families, and capacity building (e.g., skills training and access to microcredit). If a respondent answered "Yes," they were then asked to indicate the extent to which they perceived these benefits as being distributed within the broader community, including their own household. Response options were: *Not at all*, *To a small extent*, *To a moderate extent*, *To a large extent*, *To a very large extent,* and *I don't know*. Responses marked as *I don't know* were treated as missing data in the analysis. In addition, we collected respondents' age, sex, education level, length of residence and household size to explore variation in perceptions across different population groups (see Tables 1, 2).

TABLE 1 Respondents characteristics.

Characteristic WMA of residence	Burunge $n = 214$	Enduimet $n = 175$	Randilen $n = 159$	Respondents $n = 548$
Sex				
Male	91 (42.5%)	77 (44.0)	58 (36.5%)	226 (40.8%)
Female	123 (57.4%)	98 (56.8%)	101 (63.5%)	322 (59.1%)
Age group				
18–30	52 (24.2%)	43 (24.6%)	59 (37.1%)	154 (28.1%)
31–40	65 (30.4%)	39 (22.3%)	56 (35.2%)	160 (27.9%)
41–50	62 (28.9%)	46 (26.3%)	36 (22.6%)	144 (25.7%)
51–60	23 (10.7%)	24 (13.7%)	17 (10.7%)	64 (11.7%)
61–70	8 (3.7%)	4 (2.3%)	5 (3.1%)	17 (4.7%)
Over 70	4 (1.9%)	3 (1.7%)	2 (1.2%)	9 (2.9%)
Household size				
1–5	94 (43.9%)	68 (38.8%)	42 (26.4%)	204 (37.2%)
6–10	89 (41.6%)	81 (46.2%)	105 (66.0%)	275 (50.2%)
11–15	29 (13.5%)	24 (13.7%)	21 (13.2%)	64 (11.7%)
Over 15	2 (0.9%)	2 (1.4%)	1 (3.8%)	5 (0.9%)
Education level				
No formal education	28 (13.1%)	44 (25.1%)	46 (28.9%)	117 (21.4%)
Primary school	186 (86.9%)	40 (22.8%)	96 (60.4%)	323 (58.9%)
Secondary school	49 (22.9%)	17 (9.7%)	28 (17.6%)	94 (17.2%)
College or university	8 (3.7%)	2 (1.4%)	4 (2.5%)	17 (3.1%)
Length of residence				
Less than 1 year	9 (4.3%)	2 (1.4%)	7(4.4%)	18 (3.3)
1 year to less than 5 years	19 (8.8%)	27 (4.0%)	34 (21.4%)	60 (10.9%)
5–10 years	20 (9.4%)	8 (4.5%)	9 (5.6%)	37 (6.8%)
More than 10 years	166(77.6%)	144(49.7%)	123 (77.4%)	433 (79.0%)

TABLE 2 Descriptive statistics summarizing responses to all items used in the study.

Item	Burunge	Enduimet	Randilen	Respondents
Capacity building				
Not at all	26 (12.1%)	14 (8.0%)	15 (9.4%)	55 (10.2%)
To a small extent	70 (32.7%)	27 (15.4%)	61 (38.3%)	158 (29.4%)
To a moderate extent	44 (20.5%)	94 (53.7%)	31 (19.5%)	167 (30.5%)
To a large extent	66 (30.8%)	35 (20.0%)	50 (31.4%)	151 (27.5%)
To a very large extent	8 (3.7%)	5 (2.8%)	2 (1.2%)	15 (2.7%)
Social services				
Not at all	36 (14.6%)	29 (16.6%)	32 (20.1%)	97 (17.7%)
To a small extent	69 (28.0%)	38 (21.7%)	50 (31.4%)	157 (28.6%)
To a moderate extent	58 (23.2%)	71 (40.5%)	34 (21.4%)	163 (29.7%)
To a large extent	44 (31.3%)	35 (20.2%)	34 (21.4%)	113 (20.6%)
To a very large extent	7 (2.8%)	2 (1.1%)	9 (5.6%)	18 (3.2%)
Employment				
Not at all	127 (59.3%)	82 (46.8%)	71 (44.6%)	280 (51.1%)
To a small extent	33 (15.4%)	39 (22.3%)	45 (28.3%)	117 (21.3%)
To a moderate extent	38 (17.7%)	22 (12.6%)	20 (12.6%)	80 (14.6%)
To a large extent	8 (3.7%)	19 (10.8%)	16 (10.1%)	43 (7.8%)
To a very large extent	8 (3.7%)	13 (7.4%)	7 (4.4%)	28 (5.1%)
Scholarships				
Not at all	115 (53.7%)	66 (37.7%)	42 (26.4%)	223 (42.5%)
To a small extent	70 (32.1%)	49 (28.0%)	67 (42.1%)	186 (33.9%)
To a moderate extent	20 (9.3%)	38 (21.7%)	39 (24.5%)	97 (17.7%)
To a large extent	4 (1.8%)	14 (8.0%)	9 (5.6%)	27 (4.9%)
To a very large extent	5 (2.3%)	8 (4.6%)	2 (1.2%)	15 (2.7%)

3.2.3 Key informant interview

Following the questionnaire, we conducted 20 key informant interviews to gain deeper insights and contextual understanding of community-level benefits from WBT within WMAs. We purposefully selected respondents based on their firsthand experience and institutional knowledge of WMA governance, WBT operations, community development and wildlife conservation. This approach ensured representation of diverse stakeholder groups actively involved in WBT-related activities. Participants included WMA leaders (3), village game scouts (3), village leaders (2), community elders (5), district wildlife officers (2) and tour guides (2). In stakeholder categories, where only two participants were included, such as district wildlife officers and tour guides, this reflected the consistency of information across WMAs due to standardized mandates and practices. WMA-specific details were primarily obtained from WMA leaders, who are directly responsible for site-level governance and implementation. We collected data using a semi-structured interview guide, which maintained thematic consistency across interviews while allowing flexibility to capture diverse perspectives. The interview guide was designed around the study objectives without imposing predefined categories. Topics explored included the types of benefits perceived from WBT, their frequency, accessibility and the extent of community involvement related to decision-making processes. Key areas of focus included employment opportunities, education and scholarships, access to natural resources, social services and participation of women and youth. To contextualize the reported benefits, we also reviewed financial records from each WMA for the financial years 2020/21, 2021/22, and 2022/23 (see Supplementary Table S2).

3.3 Data analysis

3.3.1 Quantitative analysis

We used an ordinal logistic regression model in R (v4.2.3), to quantify associations between socio-demographic factors and perceived WBT benefits at both the household and community levels. The response variable was perceived benefits, measured on a five-point ordinal scale: *Not at all, To a small extent, To a moderate extent, To a large extent,* and *To a very large extent*. Predictor variables included benefit type (scholarship, employment, social services and capacity building), sex (female and male), age group (18–30, 31–40, 41–50, 51–60, and over 60), education level (no

formal education, primary, secondary and college or university education), length of residence in the village (less than 1 year, 1 year to less than 5 years, 5–10 years, and more than 10 years), and WMA of residence (Burunge, Randilen, and Enduimet).

We fitted the models using the cumulative link mixed model [*clmm()*] function from the *ordinal* package (Christensen, 2022) with a logit link. WMAs were treated as the main predictor, and we included two-way interactions between WMA and each socio-demographic variable (benefit type, age, sex, education level and length of residence) to assess whether the relationships between socio-demographic factors and perceived benefits varied across WMAs. To account for repeated observations from multiple members within the same household, we included a random intercept for households, thereby controlling for intra-household correlation.

We evaluated all terms in the model using analysis of deviance with the *anova()* function from the *ordinal* package and considered terms to be statistically significant at $\alpha = 0.05$ ($p < 0.05$). For significant interactions, we performed Tukey-adjusted pairwise comparisons of estimated marginal means and predicted log-odds of perceived benefits using the *emmeans* package (Ressell, 2023). We visualized the results with *ggplot2* (Wickham, 2016) to illustrate specific group differences.

3.3.2 Qualitative data analysis

We analyzed the qualitative data from key informants' interviews using thematic analysis with inductive coding, allowing themes to emerge naturally from the participants' narratives without using a predefined coding framework. This approach suited the exploratory nature of our study and helped us capture local communities lived experiences and perspectives toward WBT.

We repeatedly read the transcripts and applied open coding, then grouped similar codes into broader thematic categories. Through this iterative process, we identified key themes that reflect community experiences with WBT across the three WMAs. Emergent themes included: employment opportunities, social services, WBT investment, women and youth empowerment, cultural tourism and local guides, education and scholarships, access to natural resources and capacity building. We derived these themes directly from participants' narratives; they represent the most frequently mentioned and strongly emphasized benefit areas.

4 Results

4.1 Respondents demographic characteristics

A total of 59% of the respondents were female, and 41% were male. The age distribution was 18–30 years (28.1%), 31–40 years (27.9%), 41–50 years (25.7%), 51–60 years (11.7%), and over 60 years (7.6%). Most respondents had a primary education (58.9%), followed by secondary education (17.2%) and college education (3.1%), while 21.4% had informal education. The majority of the respondents (79.0%) had lived in the area for more than 10 years (Table 1). Table 2 presents descriptive statistics of the respondents' perceptions across different benefit types.

4.2 Types of benefits perceived by the communities across WMAs

The majority of respondents across WMAs perceived capacity building (76.0% in Enduimet, 78.6% in Burunge and 87.3% in Randilen), and social services and livelihood support (65.4% in Enduimet, 76.9% in Randilen and 77.5% in Burunge) as providing tangible benefits to their households. In contrast, employment was perceived as the least beneficial, with only 32.1% in Burunge, 34.7% in Randilen and 36.5% in Enduimet reporting positive impacts. Perceived benefits from scholarship programmes were more variable, ranging from 39.1% in Burunge and 47.1% in Enduimet to 67.6% in Randilen (Figure 3). As shown in Table 3, communities in the WMAs also reported a diverse range of actual benefits perceived related to capacity building, employment, scholarships, social services and livelihood support. The most frequently cited examples include support for local groups (14.6%) and classroom construction or repair (13.8%) in Burunge; scholarship awards (13.3%) and health insurance provision (12.5%) in Enduimet; microcredit and entrepreneurial training for local groups (15%), along with access to grazing areas (14%), in Randilen WMA.

4.3 Effects of demographic and contextual factors on perceived benefits of WBT

The ordinal logistic regression model revealed several significant interaction effects of perceived benefits as indicated by the analysis of deviance results (Table 4). The interaction between WMA and benefit type ($\chi^2 = 31.69$, $p < 0.001$) showed that perceptions of benefit varied by WMA. Respondents from Randilen reported higher perceived benefit from scholarship programmes, whereas respondents from Enduimet reported higher perceptions of employment benefits. Social services and capacity building were highly valued across WMAs and showed less variation (Figure 4). A significant interaction between WMA and age group ($\chi^2 = 13.42$, $p < 0.030$) indicated that respondents aged 31–40 years perceived benefits differently across WMAs. Enduimet WMA respondents in the age group (31–40) had the highest perceived benefits compared to Randilen and Burunge, while other age categories showed uniformly low perceptions across WMAs (Figure 5). The interaction between WMA and Education level ($\chi^2 = 14.18$, $p < 0.021$) revealed distinct patterns in perceived benefits across WMAs. Respondents from Enduimet generally reported higher perceived benefits across education levels, particularly among respondents with secondary education, compared to Burunge and Randilen WMAs (Figure 6). No significant interactions were observed between WMA and sex or length of residence in the villages.

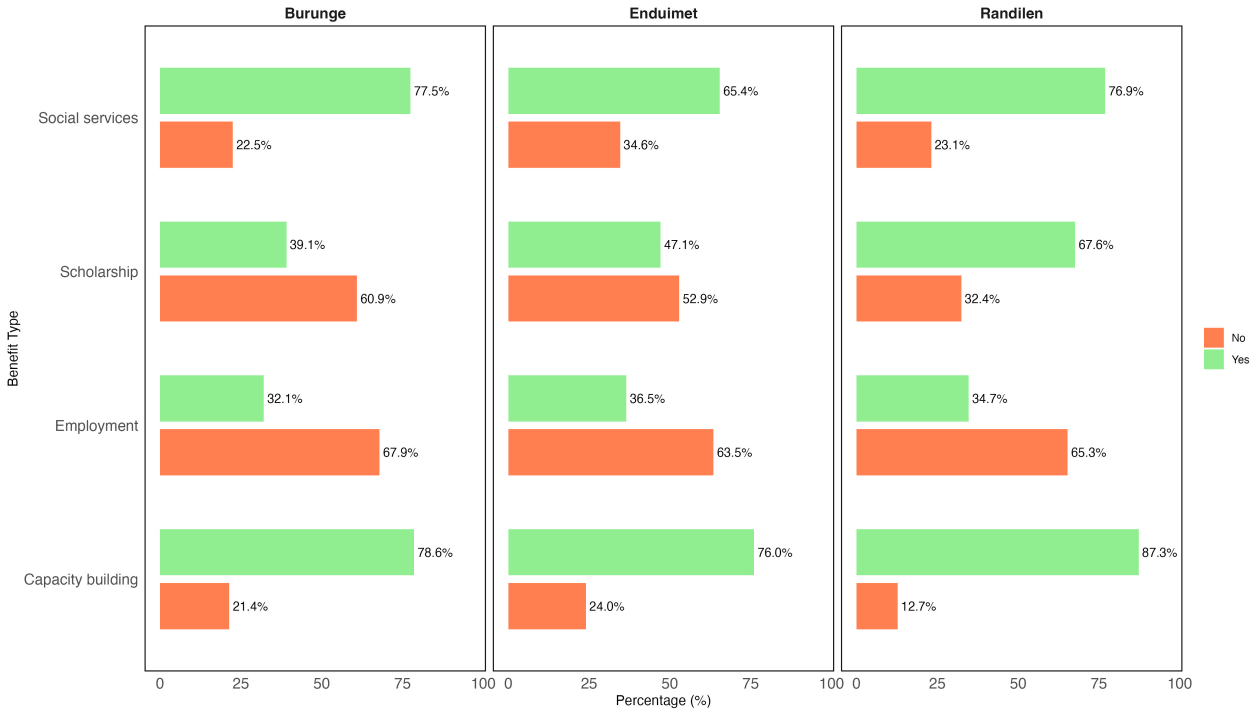

FIGURE 3
Perceived benefit type, namely capacity building, social services and livelihood support, scholarship and employment within each Wildlife Management Area (WMA).

4.4 Key informants' insights on WBT benefits across WMAs

We learned from participants that several benefits were delivered to communities across WMAs between 2021 and 2023 (Table 5). The quotes presented in this study reflect dominant, widely reported themes, rather than outlier views, ensuring that the discussion represents general community sentiments rather than isolated experiences. Capacity-building activities engaged 23 local groups, including women, youth and traditional dance groups, to improve livelihoods and promote economic empowerment. Enduimet WMA provided specialized training to 35 youth, equipping them with skills relevant to tourism employment. As one village leader noted, "*The youth training programmes have opened opportunities; now a few young people can work with tour operators, which was not common in the past.*" This indicates a perspective commonly shared among participants across Enduimet WMA, indicating an emerging shift in employment patterns and increased local participation in WBT-related activities.

In Randilen WMA, dry season grazing was permitted across more than 90% of the WMA (approximately 290 km^2), supporting pastoralist livelihoods during periods of pasture scarcity. An elder from the community explained, "*Allowing us to graze in the WMA during the dry season saved many of our animals. Without that access, it would have been a disaster for our families.*" This represents a broadly shared perspective among pastoralists, highlighting a dominant theme that flexible land use policies are crucial for sustaining local livelihoods amid environmental change.

In Burunge, 75 vulnerable households received supplementary food assistance to enhance food security. As one village chairperson noted, "*The food aid helped vulnerable families during a very difficult time. It showed us that the WMA can care about the needs of the poorest.*" This illustrates a common perspective among beneficiaries of the programme, reflecting general appreciation for WMA's support to the most vulnerable. Similarly, Enduimet WMA addressed human-wildlife conflict by compensating 66 cases of livestock loss due to lion predation, amounting to approximately US$10,000, an important measure for protecting both livelihoods and wildlife.

WBT operations collectively supported around 350 residents in tourism-related employment, offering sustainable income opportunities. Additionally, approximately 188 scholarships were awarded annually to students in advanced secondary, college and university education. Burunge also implemented a school feeding programme reaching 13 primary schools, aimed at improving child nutrition and school attendance. As one WMA Leader noted, "*Scholarships are giving our youth hope for a brighter future, and the school-feeding programme ensures our children stay healthy and eager to learn.*" This underscores a widely shared view among local leaders and community members that education-focused interventions are contributing positively to youth development.

5 Discussion

Our study examined community perceptions of WBT benefits across Burunge, Randilen, and Enduimet WMAs, highlighting

TABLE 3 Presents the percentage of respondents from each WMA who reported receiving specific benefits from Wildlife-Based Tourism (WBT) in Burunge, Enduimet, and Randilen wildlife management areas (WMAs).

WMA	Benefit type	Actual benefit perceived	Percent
Burunge	Capacity building	Support local groups (microcredit and training)	14.6
	Employment	Jobs in tourist lodges and hotels	4.9
	Education and scholarship	Scholarship support	11.8
		School feeding program	8.5
	Social services and livelihood support	Construction of classrooms	13.8
		Access NTFPs	4.9
		Food grain support	7.7
		Health insurance	12.3
		Road repair	2.8
		Healthcare facilities constructions	10.7
		Village office construction or repair	2.4
		Water facilities	9.3
Enduimet	Capacity building	Support for local groups (Microcredit and training)	7.3
	Education and scholarship	Scholarship award	13.3
	Employment	Jobs in tourist lodges and hotels	6.2
	Social services and livelihood support	Access NTFPs	12.5
		Classroom construction or repair	12.6
		Grazing areas access	7.6
		HWC compensation	8.7
		Health insurance	12.5
		Healthcare facilities	7.3
		Construction or repair of Village office	5.2
		Water facilities	6.2
Randilen	Capacity building	Support for local groups (microcredit and training)	15
	Education and scholarship support	Scholarship support	13.1
		Classroom construction or repair	9.4
	Employment	Jobs in tourism	9.4
	Social services and livelihood support	Access NTFPs	4.4
		HWC compensation	0.6
		Grazing areas access	14
		Health insurance	7.6
		Healthcare facilities	6.9
		Village office construction or repair	7.5
		Water facilities	11.2

the role of demographic and contextual factors in shaping perceptions. Perceptions of WBT benefits varied significantly across the interactions between WMA and benefit type, WMA and age, and WMA and education level, indicating that perceived benefits are shaped by location and respondent characteristics. Collective benefits, such as capacity building through local groups and improvements in social services, were generally perceived more positively than individual benefits, such as employment and scholarships. While the WMA location did not directly determine perception, it influenced how benefits were delivered and valued, highlighting the importance of local implementation contexts.

Our study reinforces this perspective by applying the SET, which further emphasizes that positive perceptions of WBT are more likely when communities perceive equitable returns (Nunkoo, 2016; Ngowi and Jani, 2018). Unlike previous studies that primarily focused on conservation and livelihood assets (Akayezu et al., 2022; Lwankomezi et al., 2021), our approach provides a more comprehensive evaluation of WBT's role in rural community development by emphasizing its link to perceived community benefits. However, it is also important to acknowledge that collective benefits are often realized either through community revenue shares from WMAs or through income generated when villages lease portions of their land to WBT investors. As noted

TABLE 4 Analysis of deviance for ordinal logistic regression model assessing factors influencing perceived benefits, including main effects and interaction terms.

Variable	Df	χ^2	Pr ($>\chi^2$)
WMA	2	1.46	0.481
Benefit type	3	354.65	<0.001
Age	4	10.13	0.038
Sex	1	20.17	< 0.001
Education level	3	49.72	< 0.001
Length of residence	3	18.85	0.041
WMA x Benefit type	6	31.69	<0.001
WMA x Age	8	13.42	0.030
WMA x Sex	2	0.09	0.956
WMA x Education level	6	14.81	0.021
WMA x Duration stay	6	19.92	0.072

by Shoo et al. (2021), such mechanisms can serve as a vital source of funding for basic social services, especially in underserved rural areas where state provision may be limited. Our study further highlights that community-level investments enhance the visibility, awareness and legitimacy of WBT initiatives. They also illustrate the need for context-specific inclusive benefit-sharing mechanisms that align with local priorities to sustain long-term community support for WBT (Lwankomezi et al., 2021; Mgonja and Uswege, 2022).

5.1 Community perceptions of WBT benefit types

The three WMAs show contrasting patterns in how communities perceive the benefits, reflecting differences in local implementation, as well as levels of community awareness and engagement, consistent with findings by Bluwstein et al. (2016) and Kicheleri et al. (2021). Perceptions can be explained by the type of benefit offered and alignment with local needs and aspirations. Overall, community members tend to prioritize collective benefits, such as improved social services, over individual incentives, including jobs and educational support for students, highlighting the complex ways in which benefits are perceived and valued (Hariohay et al., 2024, 2025). However, these apparent preferences may partly result from the greater visibility and wider reach of collective benefits rather than an inherent prioritization. In contexts where individual benefits were sufficient in number and reliably distributed, they might be equally or even more valued. This aligns with findings from Makao WMA in Tanzania (Lwankomezi et al., 2021) and Nyungwe National Park in Rwanda (Akayezu et al., 2022), highlighting the complex and context-dependent ways in which benefits are perceived, accessed and valued.

Across WMAs, differences in perspectives were also influenced by participants' roles and experiences (Mgonja, 2023). For example, elders and pastoralists emphasized benefits from grazing access, while youth highlighted training and employment opportunities. These variations illustrate how stakeholder position and direct involvement in WBT initiatives shape perceptions (Ngowi and Jani, 2018; Kitole and Sesabo, 2024).

Collective benefits have also been linked to broader participation in conservation efforts, particularly when they include mechanisms that encourage the involvement of women and youth, such as vocational training or microcredit schemes (Kaaya and Chapman, 2017; Lugalla et al., 2024). Similarly, Franco and Tracey (2019) noted that community-level benefits are appreciated for their ability to foster collaboration, strengthen social networks, and enhance long-term problem-solving capacity. The apparent preference for collective benefits may partly reflect their broader visibility and inclusiveness, rather than a genuine choice over individual incentives. In contrast, employment and scholarship opportunities are often viewed with dissatisfaction by those who do not receive them, mainly because of their exclusivity, limited availability, or perceived inequities in access (Kegamba et al., 2023). Nevertheless, even when limited in scope, individual opportunities can signal a commitment from WMAs and tourism partners. When delivered transparently and through an inclusive process, individual benefits can contribute to building trust and strengthening the legitimacy of conservation partnerships, particularly among marginalized groups such as youth and women (Snyman et al., 2023; Lugalla et al., 2024).

5.2 Influence of demographic and contextual factors on perceived WBT benefits across WMAs

Community characteristics and local implementation contexts shape perceptions of WBT benefits. These findings suggest that the effectiveness of WBT initiatives depends on both the types of benefits perceived and how these benefits interact with demographic and contextual factors. If these nuanced dynamics are not considered, WBT initiatives may unintentionally reinforce social inequalities and weaken local support for conservation (Snyman and Bricker, 2019; Kegamba et al., 2023).

Differences in WMA benefit distribution and delivery significantly shaped community perceptions. For example, Enduimet, and Randilen WMAs reported more favorable perceptions, largely due to their context-responsive benefit-sharing strategies, such as employment and scholarship opportunities. The extent to which WBT meets local expectations plays a vital role in shaping perceptions (Mdendemi and Nzunda, 2021; Hariohay et al., 2024, 2025). In contrast, Burunge WMA faced more critical community perceptions, reflecting inequities in benefit distribution and highlighting the need to rebuild trust and transparency (Kicheleri et al., 2018, 2021). Similar patterns have been reported in other Tanzanian WMAs, such as Makao and Ikona, where positive perceptions were more common among people whose livelihoods were directly tied to WBT (Mgonja and Uswege, 2022). These cases underscore that livelihood integration, local participation, and visible benefit-sharing are key drivers of positive perceptions (Snyman and Bricker, 2019; Akayezu et al., 2022). Overall, these insights affirm the importance of context-specific planning and adaptive benefit-sharing

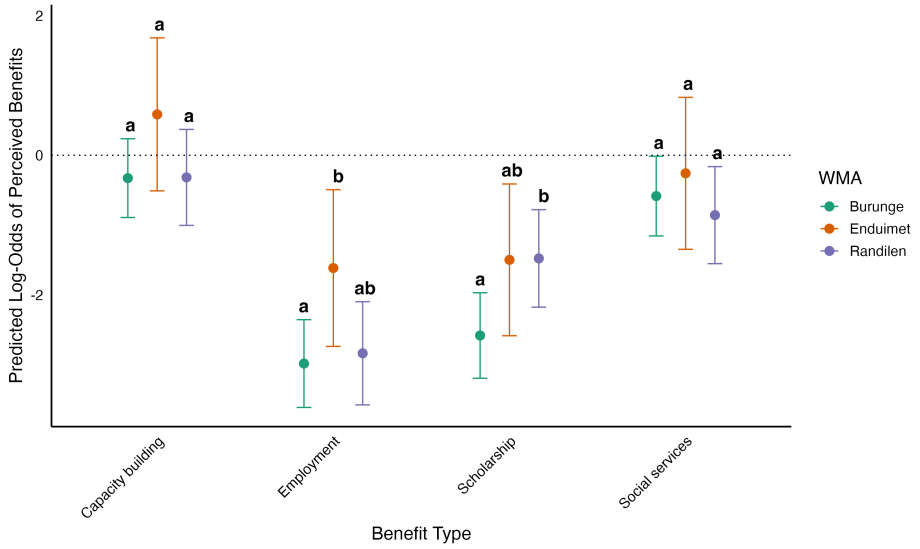

FIGURE 4
Predicted log-odds of perceived wildlife-based tourism (WBT) benefits by benefit type across WMAs from an ordinal logistic regression model. Points are model estimates; error bars are 95% Confidence intervals; the dotted line at $y = 0$ represents neutral log-odds; lowercase letters indicate significant differences among WMAs within each benefit type; groups sharing a letter are not significantly different, while different letters indicate significant differences (e.g., a>b; ab overlaps with both a and b).

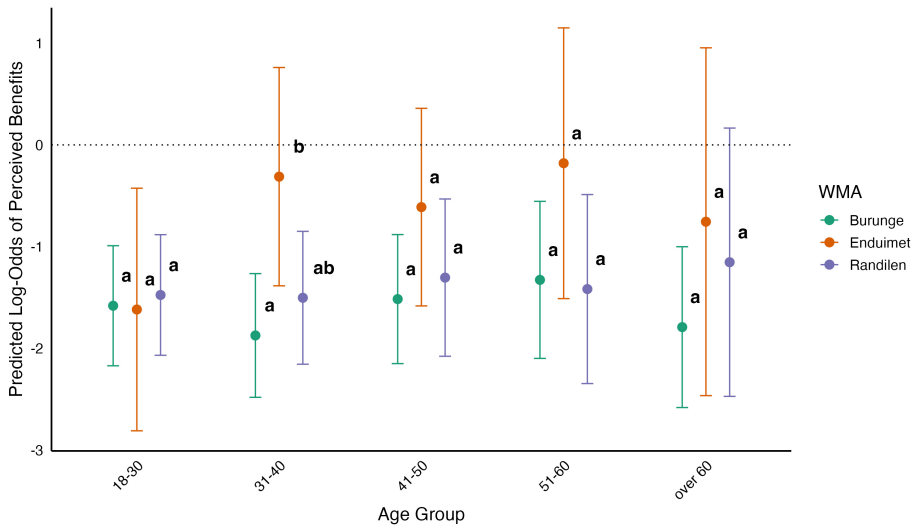

FIGURE 5
Predicted log-odds of perceived wildlife-based tourism (WBT) benefits by age groups across Wildlife Management Areas (WMAs) from an ordinal logistic regression model. Points represent model estimates and error bars represent 95% confidence intervals; the dotted line at $y = 0$ represents neutral log-odds; lowercase letters indicate significant differences among WMAs within each age group; groups sharing a letter are not significantly different, while different letters indicate significant differences (e.g., a>b; ab overlaps with a and b).

mechanisms, as perceptions varied by WMA and were shaped by how well benefits aligned with local livelihood priorities and implementation contexts.

Age also plays a key role in shaping how communities perceive WBT benefits, reflecting broader socio-cultural roles and lived experiences. Our findings show that older individuals tend to value collective benefits, such as capacity building and social services, due to their long-term involvement in community leadership and decision-making, which aligns with evidence that such experience predicts understanding of and engagement in conservation initiatives (Biru et al., 2017; Mgonja and Uswege, 2022; Mmbaga et al., 2024). In contrast, mid-aged adults in Enduimet (31–40 years) perceived certain benefits more positively attributed to targeted development initiatives or greater access to livelihood opportunities, illustrating how age interacts with the local implementation of WBT initiatives to shape recognition of benefits. These context-dependent patterns align with findings from Mutanga et al. (2016) and Hariohay et al. (2018), emphasizing

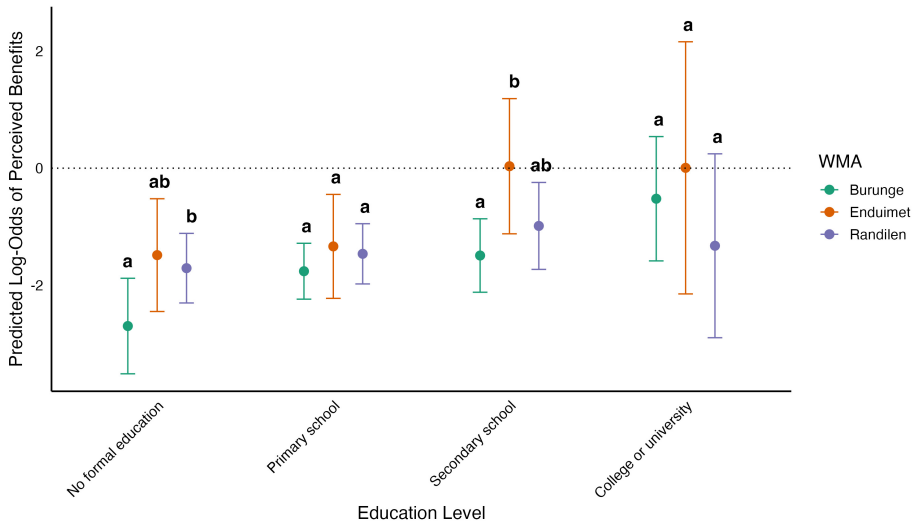

FIGURE 6
Predicted log-odds of perceived WBT benefits by education level across WMAs from an ordinal logistic regression model. Points are model estimates; error bars are 95% confidence intervals; the dotted line at $y = 0$ represents neutral log-odds; letters indicate significant differences among WMAs within each education level; groups sharing lowercase letters are not significantly different, while different letters indicate significant differences (e.g., a>b; ab overlaps with a and b).

that age-related differences in benefits perception cannot be generalized across all communities. This can underscore the importance of considering each age group distinctly in policy and programme design to ensure equitable and effective benefit delivery (Gayo and Katonge, 2025).

Education emerged as a powerful factor shaping perceptions of WBT by enhancing awareness, fostering engagement, and increasing access to conservation-related opportunities within WMAs. This finding aligns with studies from Kitole and Sesabo (2024) communities near Mount Kilimanjaro National Park in Tanzania; Ntuli et al. (2019) the Great Limpopo Transfrontier Conservation Area; and Biru et al. (2017) around Awash National Park, Ethiopia, where higher education attainment correlates with improved benefit recognition and participation in WBT decision-making. However, the influence of education was not uniform across WMAs. In Enduimet, higher education levels were strongly associated with positive perceptions, likely due to inclusive outreach and transparent benefit-sharing. In contrast, this relationship was weaker in Burunge and Randilen, highlighting the context-dependent nature of education's effect on WBT perceptions (Mmbaga et al., 2024). These differences suggest that education alone is insufficient unless supported by effective governance, clear communication, and opportunities for active engagement (Ngowi and Jani, 2018; Kitole and Sesabo, 2024). In areas with strong outreach and participatory planning, education enhances awareness of collective benefits, such as health services or road construction (Katswera et al., 2022). Moreover, in tourist areas, educated youth often gain better access to WBT employment (Odinga, 2022), further amplifying the role of education in shaping benefit perceptions. For these reasons, WMA interventions must be tailored to local education profiles, using strategies such as adult education, youth outreach, and school-based conservation education programmes (Hariohay et al., 2024, 2025).

5.3 Perspectives on locally relevant WBT benefits across WMAs

The diversity of WBT-related benefits observed across studied WMAs reflects differences in priorities and strategies for addressing community needs. Drawing on key informant insights, it became clear that the relevance and visibility of benefits, particularly those that are inclusive and enhance everyday livelihoods, reinforce the idea that the form, delivery, and perceived fairness of benefits are as important as the benefits themselves in shaping community perceptions (Ngowi and Jani, 2018).

Initiatives targeting community groups, women and youth, such as vocational training, capacity-building workshops, and microcredit programmes, were consistently recognized and appreciated by many community members. These findings align with previous studies, showing that inclusive strategies improve access to livelihood opportunities, particularly in rural areas with limited employment options (Lugalla et al., 2024). Beyond material benefits, such initiatives also strengthen participation in WBT decision-making, promoting a broader sense of ownership and commitment to conservation objectives (Shoo et al., 2021). This dynamic is evident in Randilen WMA, where the allowance of dry-season grazing was widely appreciated as it demonstrated policy flexibility that aligns with traditional pastoral practices (Safari et al., 2022). Adaptive land-use arrangements of this kind help mitigate livelihood risks during environmental shocks, particularly for pastoralist households that rely heavily on communal grazing lands (Biru et al., 2017). Together, these examples illustrate that conservation outcomes gain greater local legitimacy when management approaches align with community needs and livelihood realities.

Social welfare programs, such as food aid for vulnerable households, also enhanced perceptions of equity and inclusion. These programmes were particularly valued in marginalized areas

TABLE 5 Summary of community-reported benefits from wildlife-based tourism (WBT) across Burunge, Randilen, and Enduimet Wildlife Management Areas (WMAs), organized by key thematic areas emerged through inductive analysis of key informant interviews.

Theme	Burunge	Randilen	Enduimet
WBT investment	11 camps/lodges (6 in WMA, 5 in villages), 165 temporary workers	8 camps/lodges, 11,000 tourists/year, 65 youth employed	2 lodges, 1 hunting camp, 4,000 tourists + 15 hunters, 35 youth employed
Employment opportunities	Seasonal (cleaners, cooks, drivers, etc.), Permanent monitors	Seasonal roles, permanent staff, 35 tour guides	Seasonal roles, permanent staff, 25 guides
Guides/cultural performers	22 local guides, 3 cultural groups (~$50/performance), beekeeping	2 cultural bomas, 3 dance groups	Masai lodges, Olpopongi village, homestays
Women & youth groups	9 COCOBA groups selling handmade cultural items	COCOBA active in 6 groups (microcredit)	5 ecotourism enterprises, 4 savings groups
Scholarships & education	63 students/year, e.g., 11 from Sangaiwe village (~$500/student)	45 students (25 full, 20 partial scholarships)	55 students/year; 5 per village (low-income)
Social services	2 classrooms, Burunge secondary, offices & health centers renovated	4 classrooms, dormitory, village office, borehole & tank	1 classroom, 1 teacher's office, 2 clinics, village office, 4 boreholes
School feeding program	Lunch to 13 primary schools	Not reported	Not reported
Health insurance	Coverage for member communities	Not reported	Not reported
Special program	Food assistance (100 kg maize to 45 households, e.g., 30 in Sangaiwe village)	Dry season grazing (~90% of WMA), predator deterrents	Lion recovery fund (66 cases, USD 10,000)
NTFP access	Regulated firewood and NTFPs for domestic use	Regulated firewood and NTFPs for domestic use	Regulated firewood and NTFPs for domestic use
Capacity building	12 groups trained in hospitality, business, microcredit	Training and microcredit for women/youth groups	35 youth trained for tourism jobs

with limited government services, reinforcing the legitimacy of WBT as a mechanism for promoting rural development (Shoo et al., 2021). Similarly, compensation for livestock losses due to wildlife helped reduce tensions and maintained social trust, both of which are crucial for long-term support for conservation initiatives (IUCN, 2023; Hariohay et al., 2024). Together, these findings highlight how inclusive support mechanisms, strengthen local engagement and legitimacy in WBT.

Education-related initiatives played a particularly influential role in shaping positive perceptions of WBT. Scholarships, school feeding programmes and environmental education campaigns not only address immediate needs but also build long-term community capacity. When implemented effectively, these initiatives connect conservation to daily life, enhancing awareness and fostering a sense of ownership over WBT and natural resource governance (Katswera et al., 2022; Hariohay et al., 2024, 2025). To maximize their long-term impact, education programmes should extend beyond youth to include adult education, community-based partnerships, and hands-on conservation learning. Such approaches can bridge generational knowledge gaps, promote intergenerational engagement in WBT and foster more resilient and informed communities.

6 Conclusion

Community perceptions of WBT benefits in Northern Tanzania's WMAs are shaped by both the types of benefits provided and their alignment with local needs. Support for WBT and conservation initiatives depends on whether communities perceive benefits as relevant and responsive, consistent with SET, which highlights reciprocal and mutually beneficial relationships between communities and external actors. By applying SET in this context, this study contributes theoretically by demonstrating how the perceived relevance of benefit distribution shapes community support for wildlife conservation. It links local perceptions to broader principles of reciprocity and social obligation in African communal areas, where collective resource management and shared responsibilities are central to local governance.

Interventions that improve social services and build the capacity of local groups tend to be more inclusive and are better received than narrowly targeted individual benefits, such as employment and scholarships. Collective or village-level benefits are often more effective in raising awareness and encouraging broader participation. Effective benefit-sharing requires consideration of local contexts, histories and governance systems; as a one-size-fits-all approach risks exacerbating inequalities or alienating important segments of the community. Therefore, adaptive and participatory planning is essential to promote equitable and long-term sustainable outcomes. Strategies must also respond to demographic factors such as age, sex, education level, and duration of residency, as these shape how different groups engage with and perceive WBT benefits.

WBT has the potential to play a transformative role in community development and conservation when implemented through inclusive, locally grounded frameworks that recognize community diversity and geographical context. Addressing

context-specific benefit distribution strengthens support for conservation while promoting equitable rural development. Future research should explore how to institutionalize these frameworks and monitor their long-term impact on both social and ecological impacts.

In practice, these findings suggest that interventions in WMAs should prioritize collective, community-oriented benefits, such as capacity-building initiatives and social services, which are widely recognized and appreciated by rural communities. Improving educational access and attainment, particularly at the secondary education level and beyond, may further strengthen community engagement and perceptions of development programs. Tailoring programs to these insights can increase effectiveness, especially in communities like Enduimet, where these patterns are most pronounced. It is important to note that this study focused on perceived benefits and did not account for the costs or trade-offs associated with WBT, which could influence overall community perceptions. This represents a limitation of the study. Incorporating both benefits and challenges or costs in future research would provide a more comprehensive understanding of how communities evaluate and respond to WBT initiatives in WMAs.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Tanzanian Commission for Science and Technology (COSTECH), Permit No. 2022-818-NA-2022-344. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their verbal informed consent to participate in this study.

Author contributions

SK: Conceptualization, Writing – review & editing, Supervision, Software, Investigation, Methodology, Formal analysis, Project administration, Writing – original draft, Resources, Funding acquisition, Data curation, Visualization, Validation. SM: Investigation, Visualization, Formal analysis, Validation, Data curation, Writing – review & editing, Supervision, Methodology, Conceptualization. AK: Visualization, Writing – review & editing, Methodology, Data curation, Investigation, Conceptualization, Validation. SS: Data curation, Validation, Visualization, Conceptualization, Writing – review & editing, Methodology, Investigation. LS: Writing – review & editing, Formal analysis, Visualization, Data curation, Validation, Conceptualization, Methodology. AD: Writing – review & editing, Methodology, Validation, Investigation, Visualization, Data curation, Conceptualization. DH: Methodology, Supervision, Data curation, Conceptualization, Investigation, Writing – review & editing, Validation, Formal analysis, Visualization. NM: Visualization, Data curation, Validation, Methodology, Writing – review & editing, Investigation, Conceptualization, Supervision.

Funding

The author(s) declared that financial support was received for this work and/or its publication. SK received support from the Weatherby Foundation International (USA). DH received support from Jamma Conservation and Communities, Oppenheimer Generations Research and Conservation, and the BAND Foundation. AD acknowledges support from the Recanati Kaplan Foundation and Panthera.

Acknowledgments

We are grateful to all our respondents, particularly the local communities of Burunge, Randilen, and Enduimet WMAs. We also thank the research assistants who supported the questionnaire translation and data collection, as well as the community members who dedicated their time to meetings and participants for the key informant interviews.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The reviewer JN declared a shared affiliation with the author SK to the handling editor.

The author SS declared that they were an editorial board member of Frontiers at the time of submission. This had no impact on the peer review process and the final decision.

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