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Urban-Rural Linkages and Cultural Ecosystem Services in a Tanzanian Secondary Town

The Case of Iringa

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Abstract

Urban-rural linkages shape access to heritage, recreation, spirituality and place-based knowledge, yet their implications for cultural ecosystem services (CES) in African secondary towns remain underexamined. This exploratory mixed-methods study examined Iringa, a rapidly growing Tanzanian secondary town with strong hinterland relationships, using questionnaires completed by 80 household heads, 17 key-informant interviews, field observation and GIS mapping. Recreation and tourism (95.0%) and cultural heritage (90.0%) were the most widely recognised services, while 60.0% reported daily urban-rural travel. Nine in ten respondents perceived community involvement in conservation, although the binary item did not record activity type or personal participation. Cultural and livelihood benefits coexisted with infrastructure deficits, degradation, urban expansion and deforestation. The linkage-CES framework traces how physical, financial, socio-cultural and information flows are mediated by access, institutions, custodianship, participation, power and land-use change, producing differentiated outcomes and feedbacks. Given 20 household non-responses, overall findings remain descriptive and exploratory rather than representative.

Keywords: Cultural ecosystem services, urban-rural linkages, urban-rural flows, relational values, secondary towns, spatial planning, Tanzania

INTRODUCTION

Cultural ecosystem services (CES), including recreation, spirituality, identity, learning and aesthetic experience, are co-produced through relationships among people, practices, institutions and places (MEA, 2005; Fish et al., 2016; Díaz et al., 2018). Urbanisation reshapes them through changes in access, land use, custodianship, livelihoods and meaning. This matters in sub-Saharan African secondary towns that retain strong hinterland connections (Agergaard et al., 2019; UN-Habitat, 2020). Their physical, financial, socio-cultural and information flows may extend access and stewardship but may also intensify conversion, commodification and degradation, as recent evidence on Nairobi's green-space loss indicates (Edwin & Kasuku, 2025).

The Iringa-specific Problem and Case Rationale

Iringa is analytically useful because its growing municipal core remains connected to surrounding areas through farming, trade, kinship, ceremony, tourism and recreation. Cultural landscapes including Isimila Stone Age Site, Kalenga/Chief Mkwawa, Gangilonga Rock, Igeleke rock art, and sacred and scenic places support memory, education, spirituality and livelihoods. Iringa is not presented as representative of all Tanzanian secondary towns; it was selected because diverse CES, custodial arrangements and development pressures coexist within one functional territory. Roads, transport, digital communication and tourism promotion increase access, while settlement expansion, conversion, deforestation and unmanaged visitation may weaken ecological condition, customary control and meaning. The case therefore reveals the conditions under which connectivity may support or diminish CES.

Research Gap and Contribution

Urban-rural scholarship emphasises migration, markets, food systems and services, whereas CES studies often examine discrete sites or valuation

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categories. Consequently, the mechanisms through which territorial flows shape cultural outcomes remain poorly specified in African secondary towns (Somanje et al., 2020; Mercandalli et al., 2023). Tanzanian studies illuminate sacred-site conservation, indigenous knowledge, peri-urban land-use change and rural tourism (Kombe, 2005; Mhache, 2018; Sanga & Haulle, 2022; Haulle et al., 2024), but rarely integrate these processes across a town hinterland region. This study addresses that gap by tracing four flows through accessibility, institutions, custodianship, participation, power and land-use change.

Aim and Objectives of the Research

The overall aim was to examine how urban-rural linkages shape the recognition, access, benefits and sustainability of cultural ecosystem services in Iringa Municipality and its hinterland.

The objectives were to:

i. Examine the forms of urban-rural linkage that structure interaction between Iringa Municipality and its hinterland.
ii. Assess the cultural ecosystem services recognised, accessed and valued by communities.
iii. Analyse the mechanisms through which urban-rural linkages enhance or undermine cultural ecosystem service sustainability.

THEORY

The literature review examines urban-rural linkages and cultural ecosystem services, Tanzanian evidence and the legal-institutional context, before identifying the analytical gap. It then integrates the relevant theoretical perspectives within the conceptual framework guiding the study.

Urban-rural Linkages and Cultural Ecosystem Services

Urban-rural linkages are movements of people, goods, capital, information and cultural practices between settlements and hinterlands (Tacoli, 1998; Satterthwaite & Tacoli, 2003). Physical flows affect access; financial flows connect visitation with enterprise and conservation; socio-cultural flows sustain kinship, ceremony and knowledge; and information flows shape awareness. Secondary towns often lack functional-region governance, making integrated territorial planning central to African policy (African Union, 2015; UN-Habitat, 2016; African Development Bank & Cities Alliance, 2022). CES include recreation, heritage, spirituality, education, aesthetics, sense of place and traditional knowledge (MEA, 2005; Daniel et al., 2012). These values are plural and relational, so limited visitation need not imply low importance (Chan et al., 2016; Fish et al., 2016).

Global South scholarship shows that CES assessments often understate relational values, obligations, inequality and local knowledge (McElwee et al., 2022; IPBES, 2022; Pascual et al., 2023). This study therefore interprets survey frequencies with qualitative evidence. Participatory GIS research in Nakuru and Udon Thani shows that proximity, affordability and usability shape unequal access (Tuhkanen et al., 2022). For Iringa, transport cost, seasonality, permission, information and cultural suitability may matter beyond road distance. Infrastructure and digital media can widen use and income, while land conversion and unmanaged visitation can erode integrity (Plieninger et al., 2015). Fragmented African peri-urban governance compounds these risks (Ingwani et al., 2024), and CES remain underrepresented in East African ecosystem-service research (Osewe et al., 2024).

Tanzanian Evidence and Legal-Institutional Context

Tanzanian evidence shows that CES are sustained by customary institutions yet exposed to demographic, infrastructural and market change. Research on Dar es Salaam demonstrates how peri-urban land conversion can outpace coordinated planning (Kombe, 2005). In Makete, rules, taboos and sanctions conserved sacred and natural forests, while modernisation weakened knowledge transmission (Sanga & Haulle, 2022), consistent with Bhagwat's (2009) treatment of sacred natural sites as ecological and spiritual systems. Indigenous knowledge can support stewardship (Mhache, 2018); rural tourism can diversify livelihoods where ownership and institutional support exist (Haulle et al., 2024); and community engagement can sustain vernacular knowledge (Rweyemamu et al., 2026). These studies, however, generally separate conservation, knowledge, land-use change and tourism rather than tracing their interaction across a secondary town and its hinterland.

Tanzania's legal architecture is broad but sectorally

divided. The Environmental Management Act (2004) assigns environmental management duties; the Land Use Planning Act and Urban Planning Act (2007) provide spatial planning and development-control instruments; the Antiquities Act (Cap. 333) protects places and objects of archaeological, historical or natural interest; and the Tourism Act (2008) regulates tourism institutions and activities. The National Human Settlements Development Policy (2000) promotes orderly, environmentally responsible settlement development (United Republic of Tanzania, 1964, 2000, 2004, 2007a, 2007b, 2008). The gap is therefore not an absence of mandates but weak integration around relational and place-based values. Acting separately, these instruments may produce roads without heritage safeguards, tourism promotion without visitor-management controls, or statutory plans that overlook sacred sites and customary custodians. The unresolved question is how formal mandates interact with community knowledge, access and benefit-sharing across the functional urban region.

Synthesis and Analytical Gap

Cultural benefits arise through relationships among landscapes, users, custodians, institutions and flows, but existing scholarship does not adequately explain how these relationships operate together across a secondary town and its hinterland. Studies rarely examine whether physical, financial, socio-cultural and information flows simultaneously expand access, reproduce meaning, distribute benefits and create pressure, or distinguish recognition from accessibility and importance (Somanje et al., 2020; Mercandalli et al., 2023). This study addresses that mechanistic and territorial-scale gap by combining household perceptions, key-informant knowledge, observation and GIS within a plural, place-sensitive framework (McElwee et al., 2022; IPBES, 2022).

Conceptual Framework

The conceptual framework draws on urban-rural interaction theory, relational cultural ecosystem services (CES) theory and a social-ecological systems (SES) perspective. Urban-rural theory identifies multidirectional flows that create functional territories beyond administrative boundaries (Tacoli, 1998; Satterthwaite & Tacoli, 2003). It shows how mobility enables encounters with cultural landscapes but gives limited attention to the plural meanings that make them valuable.

Relational CES theory explains benefits as co-produced through ecosystems, practices, memories, identities and relationships (Chan et al., 2016; Fish et al., 2016). K'oyoo (2025) similarly links sense of place to attachment, identity, dependence and meaning. Whereas urban-rural scholarship begins with flows and territorial change, CES scholarship begins with valued places and experiences. Together they explain how people encounter landscapes and how encounters gain spiritual, recreational, educational, livelihood and identity value. The SES perspective adds the conditions under which connections and benefits endure: institutions, power, custodianship, participation, land-use change and ecological feedbacks (Ostrom, 2009; Masterson et al., 2019). Rather than repeating a typology of flows or values, it explains how rules, actor relationships and landscape conditions shape who benefits, who bears costs and whether use reinforces stewardship or degradation.

These perspectives are complementary: urban-rural theory asks what connects whom and where; relational CES theory asks how connections become meaningful benefits; and the SES perspective asks for whom, under which governance and power relations, and with what landscape consequences. Together, they provide the conceptual grounding for the framework presented in **Figure 1**.

Building on these perspectives, the conceptual framework presented in **Figure 1** links flows, mediating conditions, outcomes and feedbacks. Physical flows comprise travel; financial flows include spending, income and investment; socio-cultural flows include ceremonies, worship, kinship and intergenerational exchange; and information flows include knowledge shared through media, meetings, institutions and personal networks. A heritage visit may combine all four, but they remain analytically distinct because their effects may differ.

Six conditions mediate flows. Accessibility covers the ease and means of reaching sites; land-use change includes expansion, deforestation and degradation; institutions encompass formal mandates; and custodianship covers locally recognised responsibilities. Participation records

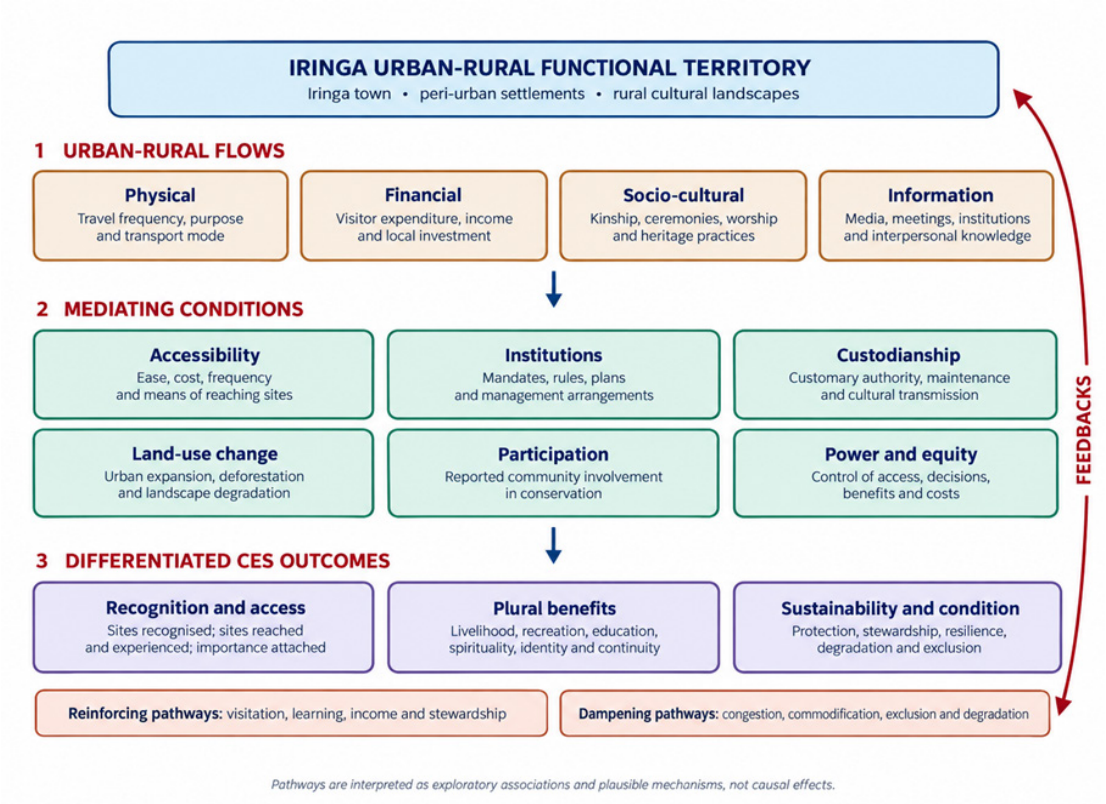


FIGURE 1
Linkage-CES conceptual framework connecting urban-rural flows, mediating conditions, differentiated cultural ecosystem service outcomes and feedbacks
Source: Authors' synthesis, informed by Tacoli (1998), Ostrom (2009), Fish et al. (2016) and Masterson et al. (2019)

perceived community involvement, not activity type or personal roles. Power concerns who controls access, decisions and the distribution of benefits and costs. These conditions explain why similar flows can generate unequal outcomes. Outcomes distinguish recognition, experience and consequence. Recognition identifies known CES; accessibility and importance capture whether and how strongly they are experienced; benefits include livelihoods, learning, recreation, spirituality, identity and continuity; and pressures include degradation, conversion, crowding and commercialisation. This prevents frequently mentioned services from being assumed to be the most important or equitably accessible.

Feedback makes the framework dynamic. Income or recognition may finance maintenance and strengthen custodianship, while degradation, exclusion or commercialisation may reduce later access and continuity; information and participation may encourage stewardship. The cross-sectional evidence cannot establish these cycles causally, but identifies plausible pathways for interpretation and testing.

RESEARCH METHODS

The research methods describe the study area and design, operationalisation of the conceptual framework, sampling and data collection, research ethics, and procedures for data analysis and triangulation.

Study Area and Research Design

The study adopted an exploratory, convergent mixed-methods case-study design (Fetters et al., 2013) in Iringa Municipality and selected functionally connected peri-urban and rural areas. Iringa Urban District recorded 202,490 residents in the 2022 census (National Bureau of Statistics [NBS], 2022). Iringa was selected because its compact urban centre is connected through roads, trade, tourism and social networks to cultural landscapes in Kalenga, Mseke, Kihesa, Gangilonga and adjoining wards. The unit of analysis was the

urban–rural linkage as experienced by households and expressed at selected CES sites; institutional arrangements and site conditions supplied contextual evidence.

The location of Iringa Municipality and the selected study wards is presented in **Figure 2**.

Operationalisation of the Conceptual Framework

Each concept in **Figure 1** was linked to an observable indicator and data source. Physical flows were measured through travel frequency, journey purpose and transport mode, supplemented by route observations and GIS measures of site relationships to roads and settlements. Financial flows were indicated by reported tourism expenditure and tourism-linked household income, together with interview evidence on local enterprise and benefit distribution. Socio-cultural flows were captured through reported family gatherings, ceremonies, religious events and heritage visits, and through elders' accounts of cultural transmission. Information flows were examined through reported sources of awareness, perceived influence of media, meetings and institutional communication, and key-informant accounts of planning and monitoring information.

Accessibility was operationalised through Likert-scale ratings, travel frequency and mode, observed route conditions and mapped site-road-settlement relationships. Land-use change was indicated by reported urban expansion, deforestation and degradation, field observations at site edges and GIS identification of spatial overlap or pressure hotspots. Institutions were examined through interview evidence on mandates, rules, planning and management arrangements. Custodianship was identified through elder and community-leader accounts of ritual, heritage and site-maintenance responsibilities. Participation was indicated by the binary survey item on whether communities were involved in conservation and interpreted alongside interview and observation evidence; it was not treated as a measure of individual activity or intensity. Power was treated qualitatively through evidence about who controlled access and use, participated in decisions, and received revenues or bore costs; no composite quantitative power index was inferred from the household survey.

CES outcomes were operationalised through recognition frequencies; ratings of accessibility and importance; reported livelihood, employment, educational, recreational, spiritual,

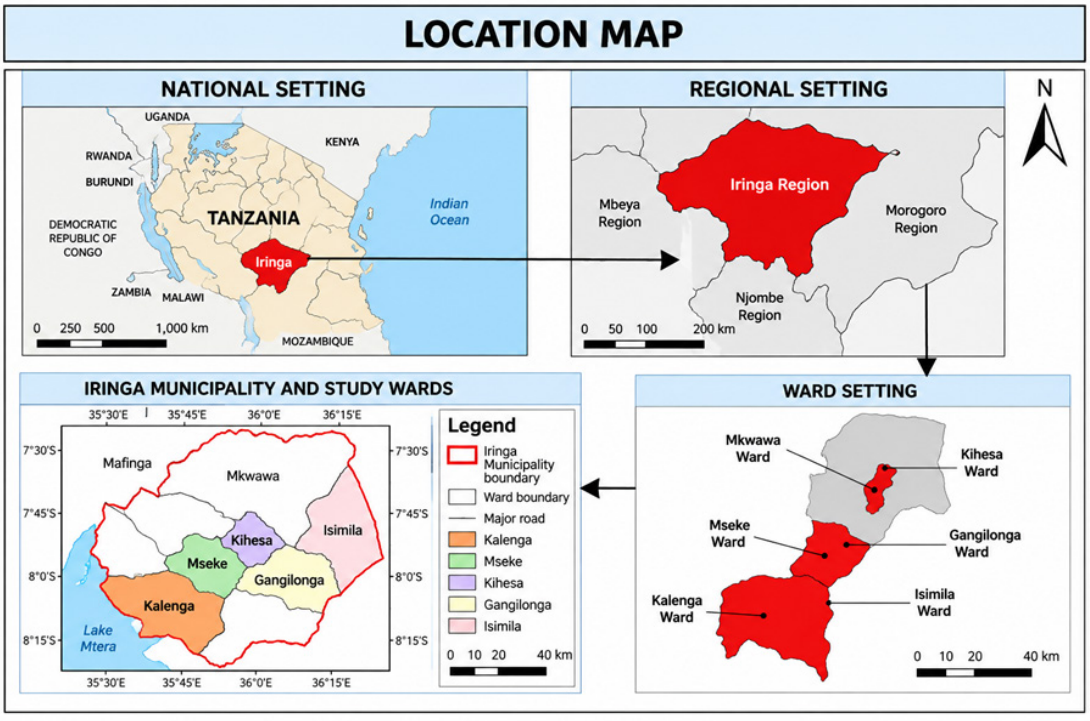


FIGURE 2
Location of Iringa Municipality and the study wards
Source: Authors' GIS analysis (2026), using NBS boundary data (2022)

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identity and cultural-preservation benefits; and qualitative accounts of meanings attached to particular landscapes. Feedback was identified where interview, observation or GIS evidence indicated that visitation, income or information influenced investment, stewardship, participation or site condition or that degradation and exclusion altered subsequent access and use. Triangulation across sources was used to assess the coherence of these proposed pathways, while the cross-sectional design limited interpretation to associations and plausible mechanisms rather than causal effects.

Sampling and Data Collection

The sampling frame used 2022 census ward household totals (NBS, 2022): Gangilonga 2,261, Kalenga 3,002, Kihesa 6,381 and Mseke 3,813 (total 15,457). The target of 100 households was allocated proportionally as 15, 19, 41 and 25, respectively. Within each ward's accessible sampling frame, occupied households were assigned identification numbers and selected using randomly generated numbers. The household head was invited to respond; non-participating selected households were recorded as non-responses and were not replaced. An initial sample-size calculation using Yamane's (1967) formula, $n = N/[1 + N(e^2)]$, with N = 15,457 households and a 10% margin of error (e = 0.10), yielded 99.36, rounded to a target of 100 households. Eighty household heads completed the questionnaire: 11 in Gangilonga, 41 in Kihesa, 16 in Kalenga and 12 in Mseke. Relative to the ward targets, non-response comprised four households in Gangilonga, none in Kihesa, three in Kalenga and 13 in Mseke, producing 20 non-responses and an overall response rate of 80%. Uneven completion, particularly in Mseke, reduced proportionality in the achieved sample. The 17 in-depth key-informant interviews supplied institutional, cultural, tourism and community perspectives for interpretation and triangulation; they complemented the survey but did not statistically replace household non-response. All reported survey analyses used the 80 completed questionnaires. Household percentages and means are therefore interpreted as exploratory and descriptive rather than as representative estimates for Iringa Municipality.

The questionnaire operationalised the broad variables as item-level responses. Urban-rural mobility was recorded through four ordered travel-frequency categories (daily, weekly, monthly and rarely), journey purpose and principal transport mode. CES recognition used multiple-response items, while overall site accessibility was recorded on a three-category ordinal scale (1 = moderately accessible, 2 = accessible and 3 = very accessible). Overall CES importance was recorded on a two-category ordinal scale (1 = important and 2 = very important). Site condition over time was classified as degraded, no change or improved. Binary items recorded whether CES sites generated income, whether sites were well protected and whether communities were involved in conservation. Multiple-response composites counted the number of travel purposes (range 0-5), economic-benefit types (0-4), information sources (0-6), CES types (0-6), community-benefit types (0-6) and sustainability challenges (0-6).

Conservation participation was a binary item asking whether communities were involved: 72 respondents answered yes and eight no. It did not identify specific activities, personal roles or intensity. No standard recall period was specified, so answers relied on personal recollection. The item indicates perceived community involvement, not verified individual behaviour or change over a uniform period.

Key informants were selected purposively (Campbell et al., 2020) for direct institutional, livelihood or custodial knowledge. Seventeen key-informant interviews were conducted: two with town planners, one with an environmental officer, three with cultural leaders, five with tourism officers, four with community leaders and two with officials from Tanzania National Parks (TANAPA). They provided evidence on governance, cultural continuity, protected-area and landscape management, site pressures and local economic effects. Field observations documented access routes, site conditions, use and visible management practices. GIS data located CES sites, settlements and transport networks; NBS spatial layers and field locations were projected in Arc 1960/UTM Zone 36S for mapping and visual overlay.

Research Ethics

The Research Ethics Committee of Ardhi University's School of Spatial Planning and Social Sciences approved the study on 6 May 2026; no approval number was issued. Iringa Municipal Council granted administrative permission.

Participants received information about the study's purpose, procedures, duration, voluntary nature, right to withdraw, and confidentiality protections, and only consenting respondents participated. Consent included the use of anonymised quotations. Personal identifiers were excluded, records were secured, and results were reported in aggregate or by non-identifying participant category.

Data Analysis and Triangulation

Questionnaire data were analysed descriptively in IBM SPSS Statistics using valid frequencies, percentages, ordinal medians, means and standard deviations, multiple-response counts and selected cross-tabulations. Sparse cells meant that cross-tabulations were interpreted descriptively; no chi-square significance claims were made. Interview transcripts and open-ended responses were coded thematically (Braun & Clarke, 2021) and triangulated with field observations and GIS evidence using an integration-by-comparison logic (Fetters et al., 2013). Swahili quotations were translated into English for publication and checked against the interview notes to preserve meaning. Survey findings describe the 80 respondents.

RESULTS

The results are presented according to respondent characteristics, forms of urban-rural linkage, cultural ecosystem service recognition and accessibility, and reported benefits, pressures and conservation participation. Quantitative findings are complemented by interview accounts, field observations and GIS evidence.

Respondent Profile and Scope of Inference

The socio-demographic profile of household respondents is presented in **Table 1**.

Among the 80 respondents, 57.5% were aged 26-45, 78.8% had at least secondary education, and 50.0% had lived locally for more than ten years. Farming accounted for 40.0% of occupations and business for 27.5%; men comprised 63.8% and women 36.3% (**Table 1**).

Table 2 presents selected cross-tabulations available in the SPSS output. Sparse monthly-travel and non-participation cells are reported as counts and row percentages without significance claims.

Daily travellers most often reported very accessible sites (13 of 48; 27%), but not weekly or monthly travellers. CES were rated very important by 69% of women and 61% of men. Perceived protection declined from 89% among residents of less than five years to 52% among those exceeding ten years. Among respondents reporting conservation involvement, 44% described sites as degraded and 47% reported no change. Interview accounts contextualised these patterns:

"Transport and road conditions greatly affect access to cultural sites. Some routes become difficult during the rainy season but are easier in the dry season." (Interview with respondent 11, key-informant interview Iringa, 2026).

"Long-term residents can observe changes in these places. Some remain protected, while others are increasingly affected by human activity and

TABLE 1
Socio-demographic profile of household respondents

Characteristic	Distribution (n = 80)
Gender	Male 51 (63.8%); Female 29 (36.3%)
Age	18-25: 12 (15.0%); 26-35: 25 (31.3%); 36-45: 21 (26.3%); 46-55: 15 (18.8%); >55: 7 (8.8%)
Education	None 7 (8.8%); Primary 10 (12.5%); Secondary 31 (38.7%); College/University 32 (40.0%)
Occupation	Farming 32 (40.0%); Business 22 (27.5%); Government 12 (15.0%); Tourism 6 (7.5%); Other/student 8 (10.0%)
Residence	<5 years: 9 (11.3%); 5-10 years: 31 (38.8%); >10 years: 40 (50.0%)

Source: Authors' analysis, 2026

TABLE 2
Selected descriptive cross-tabulations of CES experiences within the achieved household sample (n = 80)

Comparison	Respondent group	Distribution, n (row %)
Travel frequency x CES accessibility	Daily (n=48)	Moderately accessible 2 (4%); accessible 33 (69%); very accessible 13 (27%)
	Weekly (n=19)	Moderately accessible 4 (21%); accessible 15 (79%); very accessible 0 (0%)
	Monthly (n=3)	Moderately accessible 1 (33%); accessible 2 (67%); very accessible 0 (0%)
	Rarely (n=10)	Moderately accessible 2 (20%); accessible 7 (70%); very accessible 1 (10%)
Gender x CES importance	Male (n=51)	Important 20 (39%); very important 31 (61%)
	Female (n=29)	Important 9 (31%); very important 20 (69%)
Residence duration x sites well protected	<5 years (n=9)	No 1 (11%); yes 8 (89%)
	5-10 years (n=31)	No 11 (35%); yes 20 (65%)
	>10 years (n=40)	No 19 (48%); yes 21 (52%)
Conservation involvement x site status	No (n=8)	Degraded 1 (12%); no change 6 (75%); improved 1 (12%)
	Yes (n=72)	Degraded 32 (44%); no change 34 (47%); improved 6 (8%)

Source: Fieldwork activity, Iringa, May (2026)

construction." (Interview with respondent 1, key-informant interview Iringa, 2026).

"Because we live near these places, involving communities in protection and cleaning helps us identify and report problems early." (Interview with respondent 6, key-informant interview Iringa, 2026)

Forms of Urban-rural Linkage

Daily urban-rural travel was reported by 60.0% of respondents and weekly travel by 23.8%; buses (62.5%) and motorcycles (22.5%) were the main modes. Purposes included business, farming, education, ceremonies, tourism and recreation. Field observations recorded traffic along the Kalenga-Isimila-Gangilonga-Igeleke corridor (**Figure 3**). The original and translated interview accounts show how these journeys sustain social and cultural ties:

"Many residents travel to rural areas every week to attend family ceremonies, cultivate farms, visit cultural heritage sites, and participate in traditional activities." (Interview with respondent 7, key-informant interview Iringa, 2026)

"Town and village residents remain connected through family activities, farming, celebrations and visits to relatives. These relationships also sustain awareness of historically and culturally important places." (Interview with respondent 2, key-informant interview Iringa, 2026)

"Rural travel is not only for business; we also go for family activities, farming, celebrations and visits to places associated with our history and culture." (Interview with respondent 17, key-informant interview Iringa, 2026).

The transport network linking Iringa Municipality to the selected cultural ecosystem service sites is presented in **Figure 3**.

Within the sample, 56.3% reported tourism-related spending and 48.8% reported tourism-linked income. The original and translated interviews described the associated town-hinterland exchange:

"Communities benefit through employment in tourism, guiding services, accommodation businesses, transport services, handicraft sales, food

vending, entrance fees, and increased markets for agricultural products." (Interview with respondent 3, key-informant interview Iringa, 2026).

"Heritage visitors generate community income through transport, food, handicrafts and other services; tourism can therefore connect urban and rural economic activities." (Interview with respondent 13, key-informant interview Iringa, 2026)

Within the sample, respondents reported family gatherings (85.0%), ceremonies (77.5%), religious events (73.8%) and heritage visits (63.8%). Reported information sources included radio, television, social media, meetings and institutional communication. One respondent described how such information circulated:

"We learn about these places through radio, social media and community meetings, which help people understand their history and how to reach them." (Interview with respondent 4, key-informant interview Iringa, 2026)

Cultural Ecosystem Services: Recognition, Accessibility and Importance

The cultural ecosystem services recognised by respondents are presented in **Figure 4**.

Recreation and tourism (95.0%) and cultural heritage (90.0%) were the most frequently recognised CES in the sample, followed by education and research (68.8%), traditional ceremonies (58.8%), spiritual and religious values (53.8%) and scenic landscapes (38.8%). The original and translated accounts from cultural elders linked heritage and ceremonial use to cultural continuity:

"Heritage sites preserve historical knowledge, traditional ceremonies, indigenous practices, local languages, and cultural values, while strengthening community identity by connecting younger generations with their cultural heritage." (Interview with respondent 13, key-informant interview Iringa, 2026).

"Traditional ceremonies and religious activities bring people together at places of spiritual and social importance, helping our traditions continue across generations." (Interview with respondent 5, key-informant interview Iringa, 2026).

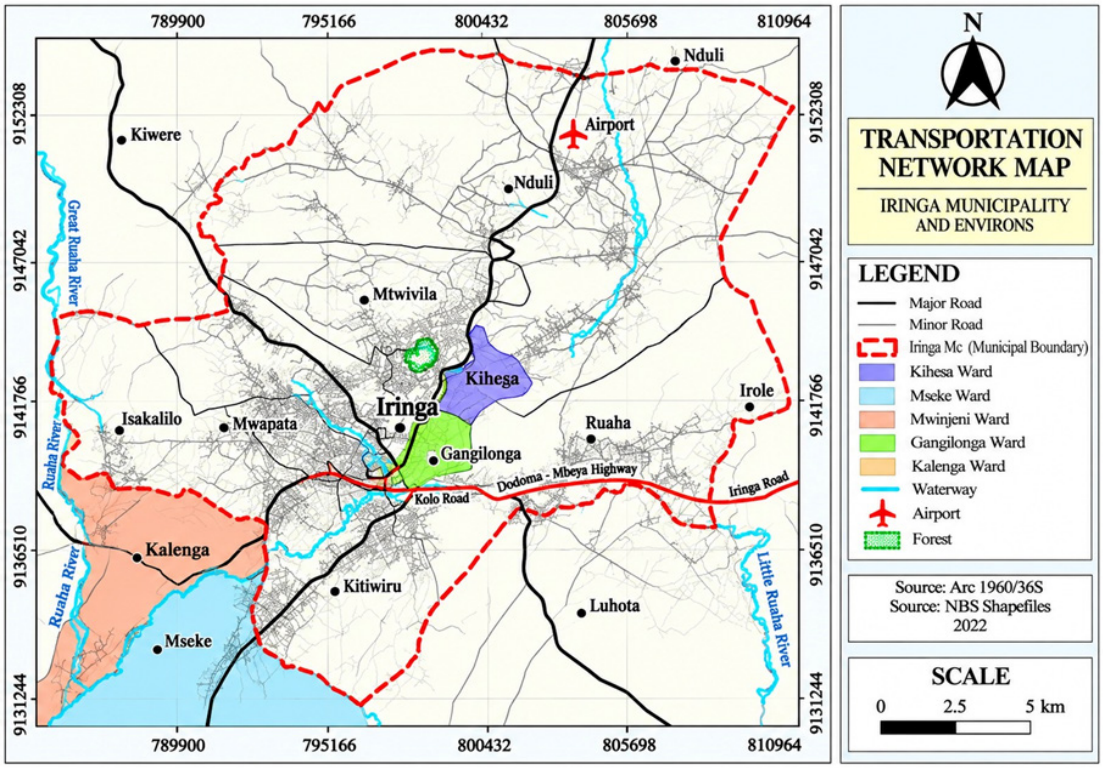


FIGURE 3
Transport network linking Iringa Municipality to selected CES sites
Source: Authors' GIS analysis (2026), using NBS spatial data (2022)

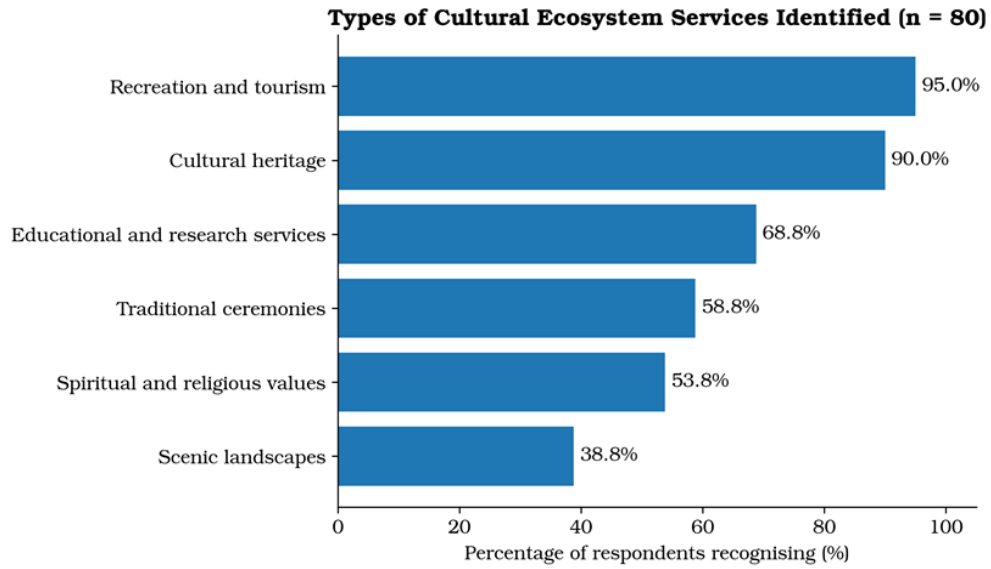


FIGURE 4
Cultural ecosystem services recognised by respondents (n = 80; multiple responses)
Source: Fieldwork activity, Iringa, May (2026)

For the overall accessibility item, 57 respondents (71.3%) rated CES sites as accessible, 14 (17.5%) as very accessible and nine (11.3%) as moderately accessible (mean = 2.06, SD = 0.54 on the three-category scale). CES were rated very important by 51 respondents (63.8%) and important by 29 (36.3%) (mean = 1.64, SD = 0.48 on the two-category scale).

Reported Benefits, pressures and conservation participation

Within the sample, respondents associated CES with income generation (95.0%), employment (92.5%), cultural preservation (78.8%), education (66.0%), recreation (52.5%) and spiritual benefit (47.5%). Key-informant interviews referred to guiding, vending, accommodation and other visitor-oriented activities, which were also observed around accessible sites. Respondents explained the economic and educational dimensions:

"The main benefits are employment and income when visitors arrive: people sell goods, provide transport or undertake other tourism-related work." (Interview with respondent 15, key-informant interview Iringa, 2026)

"Well-maintained heritage sites allow children and young people to encounter directly the history, traditions and knowledge described by elders." (Interview with respondent 13, key-informant interview Iringa, 2026)

Poor infrastructure was selected as a perceived threat by 95.0% of respondents, environmental degradation by 90.0%, urban expansion by 70.0% and deforestation by 45.0%. An environmental officer described how these conditions could affect use:

"Poor roads and environmental degradation, including pollution, may reduce visits and diminish the value of the place itself." (Interview with respondent 16, key-informant interview Iringa, 2026)

The perceived challenges affecting cultural ecosystem service sustainability are presented in **Figure 5**.

Within the sample, 72 respondents (90.0%) reported that communities were involved in conservation and eight (10.0%) reported that they were not. Because the item was binary and community-focused, it does not establish the form, frequency or intensity of conservation activity, nor whether the respondent participated personally. Interviewees described reported conservation practices and knowledge transmission:

"Communities protect these places by reporting

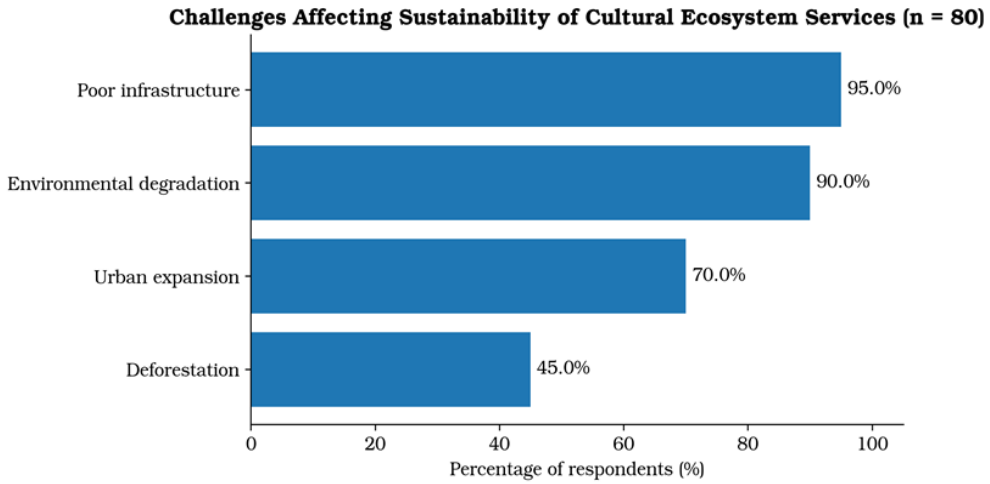


FIGURE 5
Perceived challenges affecting CES sustainability (n = 80; multiple responses)
Source: Fieldwork activity, Iringa, May (2026)

problems, helping with cleaning and observing the rules governing heritage sites." (Interview with respondent 9, key-informant interview Iringa, 2026).

"Elders are responsible for teaching young people about traditions, history and places important to the community." (Interview with respondent 4, key-informant interview Iringa, 2026).

"GIS is increasingly used for mapping cultural heritage sites, monitoring land-use changes, identifying environmentally sensitive areas, and supporting planning decisions related to conservation and tourism development." (Interview with respondent 1, key-informant interview Iringa, 2026).

The GIS overlay identified mapped concentrations of CES records around Kalenga and Mivinjeni/ Ilala. The overlay indicates spatial coincidence among mapped services, roads, settlements and reported pressures; it does not establish causal relationships. Planning and household accounts indicated how mapping could support protection:

"Land-use plans should identify culturally valuable areas early. Mapping them in development plans can reduce construction encroachment on important places." (Interview with respondent 1, key-informant interview Iringa, 2026).

"Mapping cultural places alongside roads and settlements can help leaders identify areas needing greater protection during development planning." (Interview with respondent 10, key-informant interview Iringa, 2026).

The spatial distribution of cultural ecosystem service hotspots in and around Iringa Municipality is presented in **Figure 6**.

DISCUSSION

This discussion situates the Iringa evidence within debates on secondary towns, plural cultural values and the connectivity-conservation relationship. Because the design was cross-sectional, the analysis identifies associations and plausible mechanisms rather than causal relationships. Governance, power and equity are treated as implications of the case, not as outcomes directly measured by the household survey.

Secondary Towns and Territorial Urban-Rural Relations

The reported dominance of daily and weekly travel, considered alongside evidence on transport, expenditure, kinship and information, suggests that Iringa and its hinterland operate as an interconnected territory. This pattern is consistent with accounts of African secondary towns as mediators of multidirectional mobility, services and exchange (Agergaard et al., 2019; Mercandalli et al., 2023). The Iringa case indicates that secondary-town mediation is cultural as well as economic and infrastructural. Travel for family obligations, ceremonies and worship

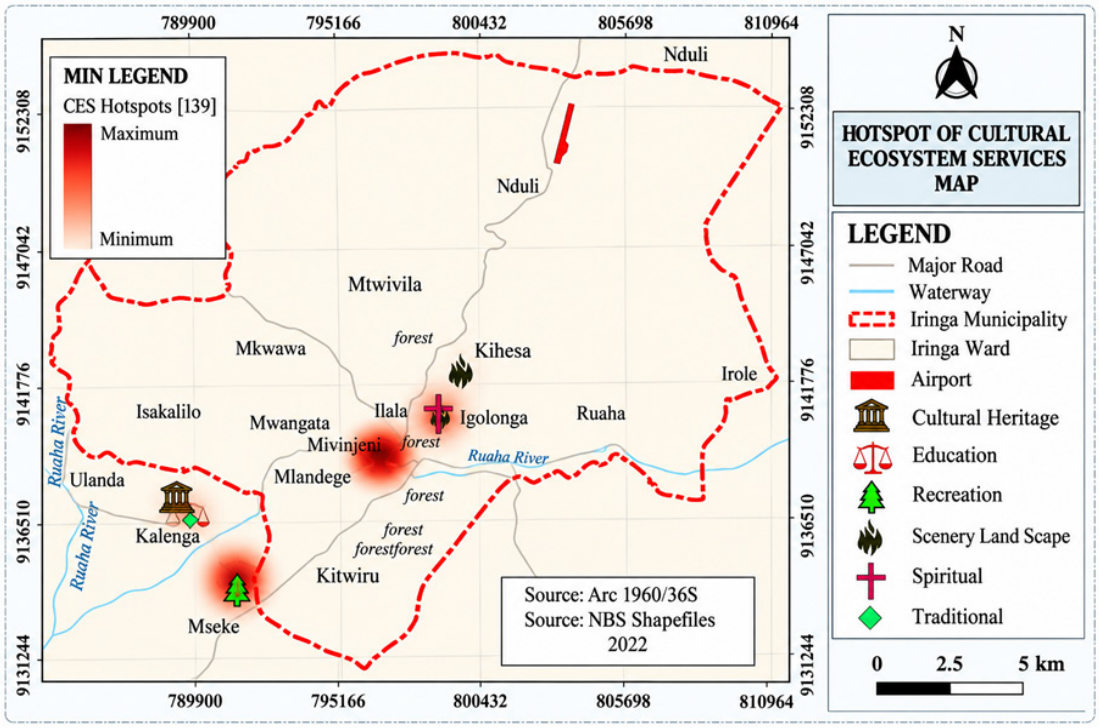


FIGURE 6
Hotspots of cultural ecosystem services in and around Iringa Municipality
Source: Authors' GIS analysis (2026), using NBS spatial data (2022)

connects urban residents with rural heritage; institutions and media circulate knowledge, while rural custodians sustain meanings that extend into the town. The case therefore adds a cultural dimension to territorial accounts of African secondary cities (African Development Bank & Cities Alliance, 2022), showing that cultural reproduction accompanies markets, migration and service exchange.

Recognition, Access and Plural Cultural Values

The difference between recognition and importance indicates why CES assessment should not rely on visibility alone. Recreation and heritage were recognised most often, whereas spiritual sites and scenic landscapes received the highest importance ratings among smaller groups of users. Within the limits of the sample, this pattern supports relational approaches in which cultural significance is understood through identity, obligation, memory and practice rather than inferred from visitor numbers or market demand (Chan et al., 2016; Fish et al., 2016). It also accords with evidence that CES contribute to well-being through multiple pathways (Kosanic & Petzold, 2020).

Accessibility emerged as a related but distinct dimension. Education and research services were reported as relatively accessible, while spiritual sites remained highly valued despite lower accessibility. The findings suggest that proximity alone does not capture access; information, cost, seasonality, social permission and cultural suitability may also matter (Tuhkanen et al., 2022). The Iringa evidence consequently supports plural valuation (IPBES, 2022; Pascual et al., 2023) and indicates that mapped roads and visitor locations represent only part of the cultural value landscape.

The Connectivity-conservation Paradox

The Iringa evidence documents infrastructure constraints, frequent movement, livelihood benefits and reported environmental pressures within the same connected landscape. Respondents associated mobility and information with access, visitation and spending, while also reporting land conversion, degradation, deforestation, crowding and commercialisation. These concurrent observations do not establish that connectivity caused either the benefits or the pressures.

The pattern suggests a conditional connectivity–conservation relationship. Africa Habitat Review

evidence associates urban sprawl with green-space loss and supports integrating land-use, ecological and planning analysis (Edwin & Kasuku, 2025; Mudenyo et al., 2026). Iringa's reported benefits and pressures also accord with evidence on landscape trade-offs, institutions and fragmented peri-urban governance (Plieninger et al., 2015; Somanje et al., 2020; Ingwani et al., 2024), while remaining consistent with a social–ecological systems interpretation (Masterson et al., 2019).

Iringa adds analytical precision by separating four forms of connectivity—physical, financial, socio-cultural and informational—and showing that they coincide with different CES experiences and pressures. Physical and financial connections were most visible in access, visitation and reported livelihoods; socio-cultural connections were prominent in ceremony, kinship and knowledge continuity; and information connections coincided with awareness and reported participation. Conservation outcomes therefore cannot be inferred from connectivity intensity alone. They may vary by linkage type, cultural service, custodial arrangement and benefit distribution, although these conditioning relationships require testing with larger, longitudinal datasets.

Governance, Equity and the Wider Planning Debate

The data directly support two limited observations relevant to governance and equity. First, most respondents reported community involvement in conservation and valued intergenerational knowledge transfer. Second, the male-skewed survey sample limits what can be concluded about women's access, work and cultural knowledge. Neither observation establishes how decision-making power, conservation costs or tourism benefits are distributed.

A broader implication is that CES governance should examine representation and authority alongside service supply. This extends beyond directly measured variables but accords with work on inequality, cultural obligations, local knowledge and plural valuation (McElwee et al., 2022; IPBES, 2022; Osewe et al., 2024). Overlapping municipal, district, customary, heritage and tourism institutions make control of access, recognition and benefit distribution important questions that the present data cannot resolve.

Synthesis and Conceptual Contribution

A synthesis of the urban-rural linkage mechanisms, evidence and analytical implications is presented in **Table 3**.

Table 3 synthesises the evidence without treating observed associations as causal mechanisms. Physical connections coincided with access and visitation, financial connections with reported income and services, socio-cultural connections with ceremony and continuity, and information connections with awareness and mapping. The conceptual contribution is a differentiated linkage CES framework that separates flows and relates them to recognition, accessibility, importance, livelihoods, cultural continuity and pressure. It asks which values become visible, who benefits and what pressures accompany connectivity. These case-grounded propositions require comparative testing.

CONCLUSION

Iringa's CES are experienced through town-hinterland relationships. Physical, financial, socio-cultural and information flows coincided with access, livelihoods, ceremony, knowledge and reported community conservation involvement, while respondents also identified degradation, conversion, deforestation, crowding and commercialisation. The study's original contribution is a differentiated linkage-CES framework that connects distinct flows to cultural outcomes, pressures and feedbacks. The findings suggest that connectivity is neither inherently beneficial nor harmful; its implications depend on how access, institutions, custodianship, participation, power and land-use change mediate particular flows. These exploratory results identify plausible mechanisms but do not establish causality.

Limitations

The study has several limitations. Although the calculated target was 100 households across four wards, 80 households completed the questionnaire, and 20 selected households did not respond, producing an 80% response rate. Household non-response may have introduced bias, while selection of household heads produced a male-skewed sample; percentages and ordinal means therefore describe participating households rather than Iringa Municipality. The

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TABLE 1
Socio-demographic profile of household respondents

Linkage	Mechanism	Main CES	Triangulated Evidence	Analytical Implication
Physical	Mobility coincided with access and visitation.	Recreation, heritage, education, scenic landscapes.	60.0% daily and 23.8% weekly travel; bus use 62.5%; road/site pattern confirmed by observation and GIS.	Access benefits and site pressures may coexist.
Financial	Visitor demand coincided with reported income and services.	Recreation/tourism and heritage.	56.3% tourism spending; 48.8% tourism-linked income; interview evidence on guiding, vending and accommodation.	Reported benefits may be unevenly distributed.
Information	Media and institutions supplied awareness and mapping information.	All CES, especially heritage and education.	81.3% link information to participation; 85.0% to heritage protection; planner account of GIS use.	Visibility does not necessarily ensure stewardship.
Residence	<5 years: 9 (11.3%); 5-10 years: 31 (38.8%); >10 years: 40 (50.0%)			

Source: Fieldwork activity, Iringa, May (2026).

17 in-depth interviews broadened contextual understanding and supported triangulation but did not compensate statistically for household non-response. The questionnaire also lacked a standard recall period for experience-based items, so responses depended on personal recollection and may reflect different reference periods. The cross-sectional design cannot establish causal or temporal relationships. Self-reported participation and perceptions were not independent measures of behaviour or environmental change, and GIS overlays show spatial coincidence rather than measured land-cover change. Finally, the evidence did not directly measure the distribution of authority, conservation costs or tourism benefits.

Future Research

Future research should test the linkage CES framework with larger, stratified and gender-balanced samples across Tanzanian secondary towns. Longitudinal land-cover and site monitoring could distinguish reported from measured change, while participatory mapping could document less visible services without exposing sensitive knowledge. Institutional research should examine authority, benefit distribution and financing, and sufficiently powered analyses should test group differences in CES recognition, access and participation.

RECOMMENDATIONS

Establish a shared CES inventory and monitoring system. The reported coexistence of frequent movement, valued cultural landscapes and environmental pressure supports development of a shared CES inventory and monitoring system. Iringa Municipal Council should lead the arrangement through its urban planning, environment and GIS functions, working with the relevant neighbouring district councils. The Antiquities Division of the Ministry of Natural Resources and Tourism should provide heritage standards and technical oversight, while ward and village authorities, recognised site custodians, cultural elders and tourism actors should validate site meanings, access conditions and locally observed pressures. A small inter-council technical secretariat housed by Iringa Municipal Council should maintain the geodatabase,

coordinate annual updates and produce a joint monitoring report.

Provide sustainable financing and clearly assign maintenance responsibilities. Financing should combine clearly assigned public and site-level sources. Iringa Municipal Council and participating district councils should finance the core database, staff time and routine field verification through their annual planning and environmental-management budgets. The Ministry of Natural Resources and Tourism, through its Antiquities and Tourism functions, should co-finance specialist heritage assessment, visitor-management standards and initial system development. Where entrance fees or tourism revenues are collected, an agreed share should be earmarked for site maintenance and community-based monitoring; external grants may support start-up costs but should not substitute for recurrent local-government financing. Maintenance responsibilities should be formalised in an inter-institutional agreement specifying data ownership, update schedules, safeguarding of sensitive cultural information and accountability for correcting or verifying records.

Strengthen participatory management and inclusive conservation monitoring. The high reported level of community conservation involvement provides an empirical basis for participatory management, although the binary survey item does not identify individual participants, activity types or decision-making power. Inventory and monitoring procedures should therefore include women, youth, cultural elders, community leaders, site managers and locally owned tourism enterprises. Mapped hotspots should guide field verification of vegetation loss, waste, crowding and disturbance, while public-facing digital information should combine visitor promotion with conservation guidance. Sensitive sacred or custodial knowledge should be recorded only with community consent and, where necessary, restricted rather than published openly.

Ethics Approval and Consent

Ethical approval was obtained from the Research Ethics Committee of the School of Spatial Planning and Social Sciences, Ardhi University, on 6 May 2026; no approval number was issued. Administrative permission was obtained from Iringa Municipal Council. Participation was voluntary, informed consent was obtained before involvement, and consent included publication of anonymised quotations. Personal identifiers were excluded, records were secured, and results were reported in aggregate or by non-identifying participant category.

Data Availability

The anonymised data may be made available by the corresponding author upon reasonable request, subject to institutional and participant-consent conditions.

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