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Research Article

Determinants of local communities' perceptions of policy effectiveness in balancing conservation and livelihood needs in Loka Abaya National Park, southern Ethiopia

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Abstract

National parks in Ethiopia face the dual challenge of conserving biodiversity, while sustaining local livelihoods. However, limited empirical evidence exists on how socio-economic, cultural and institutional factors collectively shape community perceptions of conservation policy effectiveness. This study investigates these determinants in Loka Abaya National Park, Sidama Region, Ethiopia, using an integrated framework grounded in Social exchange theory (SET) and the institutional analysis and development (IAD) framework. A mixed-methods approach was employed, combining household surveys (n = 128) with key informant interviews and focus group discussions. Determinants of policy perception were analysed using an ordered logistic regression model. Results reveal that favourable perceptions are driven by higher income, larger farmland size, greater distance from the park, education and involvement in decision-making. Notably, two counter-intuitive findings emerged: prior conflict with park authorities positively predicted favourable perceptions—likely reflecting the visibility of state enforcement—while secure land tenure predicted unfavourable views, possibly due to perceived restrictions on agricultural expansion. Conversely, larger household sizes and negative economic interactions with the Park (driven by widespread resource dependence) significantly predicted unfavourable perceptions. The findings underscore that, without viable alternative livelihoods, restrictive conservation policies exacerbate local vulnerabilities. To reconcile biodiversity goals with human well-being, policy-makers must transition from exclusionary governance to participatory, rights-based co-management. Prioritising equitable benefit-sharing, tenure-sensitive boundary delineation and conservation education are essential to enhancing policy legitimacy and long-term biodiversity outcomes in Ethiopia's protected areas.

Key words: Biodiversity conservation, human-wildlife conflict, institutional analysis and development framework, livelihoods, Loka Abaya National Park, social exchange theory

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Introduction

Protected areas (PAs) are the cornerstone of global biodiversity conservation, a role recently reaffirmed by the Kunming-Montreal Global Biodiversity Framework's ambitious target to protect 30% of the planet's land and oceans by 2030

(CBD 2022; Dudley et al. 2023). However, the expansion of PAs frequently intersects with the landscapes of local communities, reigniting historical debates over the balance between ecological preservation and human well-being (Borrini-Feyerabend et al. 2022). Globally, the legacy of "fortress conservation"—which excludes people to protect nature—has increasingly been replaced by paradigms emphasising equitable governance and community-based resource management (Bennett et al. 2019). Despite this normative shift, the implementation of inclusive conservation policies remains highly inconsistent, particularly in the Global South, where high dependency on natural resources intersects with weak institutional frameworks (Oldekop et al. 2020).

In sub-Saharan Africa, PA establishment has often restricted local communities' access to forests, grazing lands and water, inadvertently exacerbating poverty and fuelling land-use conflicts (Haruna et al. 2020). The success of conservation policies in these contexts is not solely determined by ecological metrics; it is deeply contingent on local communities' perceptions of policy effectiveness (Kumar and Routray 2022). When communities perceive policies as unjust, exclusionary or economically detrimental, conservation outcomes are undermined through non-compliance, resistance and retaliatory wildlife killings (Andrade and Rhodes 2012; Dickman et al. 2021).

Ethiopia exemplifies this paradox. The country's PAs harbour endemic species and critical ecosystems, yet they largely operate under centralised, top-down governance structures that marginalise local voices (Keane et al. 2022). While ecotourism is frequently promoted as a panacea for reconciling conservation with livelihoods, inadequate infrastructure and inequitable benefit-sharing mechanisms often result in localised costs without commensurate gains (Mekonnen et al. 2022). The Loka Abaya National Park (LANP) in the Sidama regional state is a stark manifestation of these systemic challenges. The Park encompasses vital biodiversity hotspots, but overlaps with areas where subsistence farming, livestock grazing and forest extraction are fundamental to household survival (Tadesse et al. 2021). Historically rigid conservation interventions at LANP have offered insufficient alternative livelihoods, triggering human-wildlife conflict, mistrust of authorities and local resistance.

To systematically unpack the drivers of these perceptions, this study develops an integrated conceptual framework grounded in Social Exchange Theory (SET) and the Institutional Analysis and Development (IAD) framework. SET posits that individuals rationally evaluate conservation policies through a subjective cost-benefit analysis; support is contingent on perceived gains—such as infrastructure or employment—outweighing costs like crop raiding or resource restrictions (Rasheed et al. 2022). The IAD framework complements this micro-level analysis by examining how macro-level institutional arrangements—formal rules, informal norms and governance structures—shape the "action arena" and dictate the distribution of these costs and benefits (Ostrom 2011). Synthesising these theories, this study conceptualises perceptions of policy effectiveness as a function of three interconnected domains: socio-economic, institutional and cultural factors. From a SET perspective, socio-economic drivers—such as household income, education, land ownership and spatial proximity to the Park—dictate a household's baseline vulnerability and dependence on resources, directly influencing their cost-benefit assessment (Allendorf et al. 2006; DeFries et al. 2010). For instance, households nearer to LANP facing

severe human-wildlife conflict may inherently perceive policies as ineffective. Through the lens of the IAD framework, institutional drivers—such as secure land tenure, the degree of genuine participation in decision-making and historical relations with Park authorities—determine the structural fairness of the policy environment (Mehta and Heinen 2001). Finally, cultural factors—encompassing local norms, traditional ecological knowledge and historical land-use practices—act as informal institutions that mediate how formal policies are interpreted and accepted on the ground. By mapping these variables onto the SET-IAD nexus, the framework illustrates how individual incentives and broader governance structures jointly shape whether a community perceives conservation policies as successfully balancing biodiversity with livelihood needs.

Despite growing literature on PA-human interactions, empirical research rarely applies such an integrated theoretical lens. Existing studies predominantly isolate single variables—such as income or distance—without examining how socio-economic vulnerabilities interact with institutional mistrust and cultural dissonance to shape integrative perceptions of policy effectiveness. Furthermore, data-poor and conflict-prone parks like LANP remain heavily under-researched in this regard.

This study addresses these gaps by investigating the determinants of local communities' perceptions of conservation policy effectiveness in LANP. Specifically, the study aims to: (1) identify the key socio-economic, institutional and cultural drivers shaping these perceptions; (2) evaluate how these factors influence the perceived balance between biodiversity conservation and livelihood security; and (3) provide information for the design of equitable, legitimate and effective conservation policies. By elucidating these dynamics, this research contributes to both theoretical advancements in conservation social science and practical governance reforms in Ethiopia and analogous socio-ecological systems globally.

To understand these dynamics, we developed a conceptual framework (Fig. 1) synthesizing Social Exchange Theory and the Institutional Analysis and Development framework, modified from Walle and Nayak (2022).

Materials and Methods

Study area description

The study was conducted in and around Loka Abaya National Park (LANP), located in the Loka Abaya Woreda/District, Sidama Regional State, Ethiopia (6°25'30"N to 6°48'30"N and 38°3'0"E to 38°13'30"E) (Fig. 2). Established in 2009 under Regional regulation no. 95/2009, the Park is administered by the Sidama region culture and tourism bureau (SCTB 2012; Assefa et al. 2022). LANP covers a total area of 500 km², comprising 448 km² of terrestrial land and 52 km² of Lake Abaya. The topography is characterised by a mosaic of hills, valleys and drained lowlands, experiencing a bimodal rainfall pattern with annual precipitation ranging from 374.4 to 1194.6 mm and mean annual temperatures ranging between 16.31 °C and 33.94 °C (Gebrehiwot and Hundera 2014; Assefa et al. 2024).

Ecologically, LANP is a significant biodiversity hotspot, featuring diverse habitats, such as woodlands, wooded grasslands and riparian wetlands. The Park

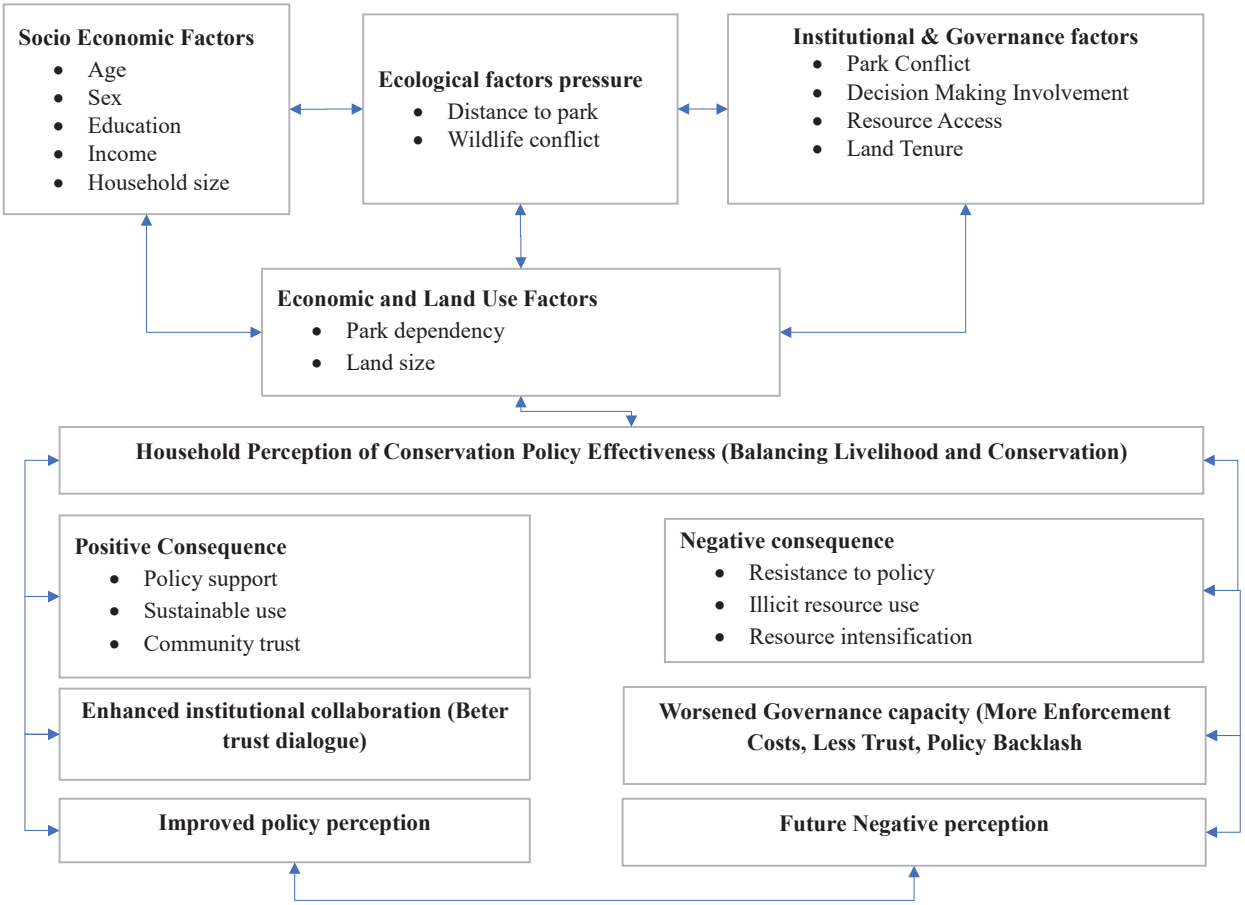

Figure 1. Conceptual framework illustrating the socio-economic, cultural and institutional drivers of local perceptions of conservation policy effectiveness, synthesised from Social Exchange Theory and the Institutional analysis and development framework (modified and developed from Walle and Nayak (2022)).

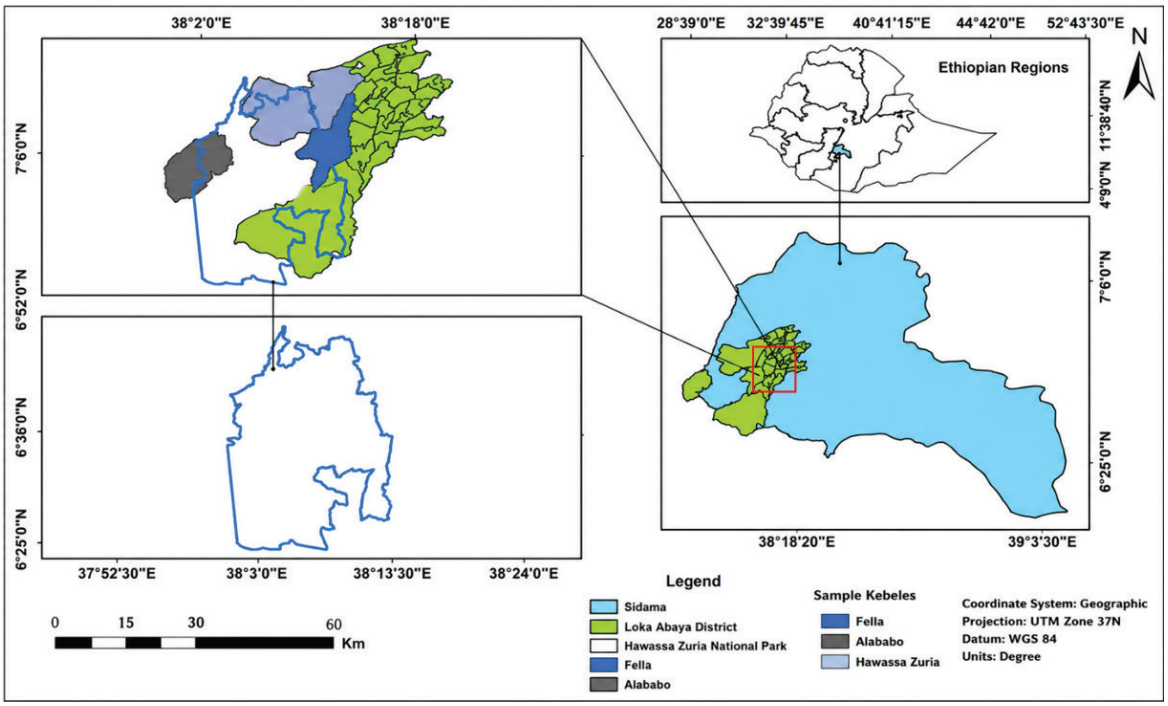

Figure 2. Map of the study area.

provides refuge for several medium and large mammals, including the greater kudu (*Tragelaphus strepsiceros*), lion (*Panthera leo*), leopard (*Panthera pardus*) and the endangered African wild dog (*Lycaon pictus*) (Dirba et al. 2020). It is also a recognised habitat for diverse avifauna, including raptors and endemic vulture species (Demeke et al. 2019).

Loka Abaya Woreda has a total population of approximately 116,873 (CSA 2007). The local economy is fundamentally agro-pastoralist, deeply intertwined with the Park's ecological boundaries. Household livelihoods rely on a highly diversified mixed-farming system designed to mitigate food insecurity. This system is anchored by the cultivation of enset (*Ensete ventricosum*), a highly drought-tolerant staple crop with deep cultural significance, supplemented by root crops, cereals and livestock rearing (cattle, sheep and goats). In lowland Kebeles adjacent to the park's rivers, local people practise small-scale irrigated agriculture, producing fruits and cash crops for local markets. In Ethiopia, a kebele (pronounced keh-BEH-leh) is the lowest and most localised administrative unit of government, roughly equivalent to a ward, neighbourhood or village council. Furthermore, vulnerable households heavily depend on natural resource extraction from the Park's periphery, including fuelwood, grass for thatching and fodder and medicinal plants, alongside small-scale beekeeping.

Crucially, this high dependence on natural resources creates a profound socio-ecological interface. The Park's boundaries overlap directly with communal grazing lands, fertile riverbanks and forested areas that local communities have historically utilised for survival. The expansion of human settlements and agricultural activities into these wildlife corridors has intensified human-wildlife conflict (particularly with crop-raiding herbivores and livestock-predating carnivores) and fuelled resource competition. This entrenched overlap between biodiversity conservation goals and community subsistence needs makes LANP a highly contested landscape and an ideal empirical setting for investigating local perceptions of conservation policy effectiveness.

Research design

To comprehensively analyse the determinants of local communities' perceptions of conservation policy effectiveness, this study adopted a mixed-methods research design. This approach facilitates methodological triangulation, merging the strengths of both quantitative and qualitative paradigms (Creswell and Plano Clark 2017).

Sampling strategy and sample size

A multi-stage sampling strategy was employed to select survey respondents. In the first stage, three kebeles (the lowest administrative units in Ethiopia) adjacent to LANP were purposively selected, based on two criteria: (1) high proximity to the Park boundary and (2) varying documented levels of human-wildlife conflict and resource dependence, ensuring maximum variation in exposure to conservation policies (Patton 2015).

In the second stage, a sampling frame of households in the selected kebeles was developed with the assistance of local kebele agricultural extension workers. From this frame, 128 household heads were selected using a systematic

random sampling technique. The sample size was determined using Yamane's (1967) formula for finite populations, set at a 95% confidence level and a 10% margin of error to account for potential non-responses or incomplete data.

For the qualitative component, purposive sampling was utilized to select 12 key informants (KIs), including park wardens, local government officials, NGO conservation staff and traditional clan leaders, based on their institutional knowledge and direct involvement in LANP governance. Furthermore, six focus group discussions (FGDs) were conducted, segmented by gender and age cohorts (male elders, female elders, male youth and female youth) to capture intergenerational and gendered differences in livelihood strategies and cultural norms.

Data collection procedures

Data collection occurred over a three-month period (March to April 2025). Prior to data collection, the survey instruments were translated into the local language (Sidaamu Afoo), pre-tested on 10 households in a non-sampled kebele and refined for clarity and cultural context.

Household surveys

A structured, face-to-face questionnaire was administered to the 128 selected household heads. The questionnaire measured household socio-demographics (age, education, household size), economic status (income, land size) and resource dependence (e.g. reliance on fuelwood, grazing, forest products). It also captured perceived costs (e.g. frequency of crop raiding) and benefits (e.g. access to ecotourism employment). IAD-aligned variables assessed institutional factors, including land tenure security, perceived fairness of benefit-sharing, level of participation in decision-making and trust in park authorities (Kumar and Routray 2022). A five-point Likert scale was used to capture perceptions of policy effectiveness in balancing conservation and livelihoods.

Key informant interviews (KIIs)

Semi-structured interview guides were used for KIIs to elicit in-depth institutional perspectives. Discussions focused on the historical trajectory of park-community relations, governance bottlenecks, enforcement practices and the implementation of benefit-sharing mechanisms. Special emphasis was placed on understanding the constraints to implementing co-management approaches and tenure-sensitive conservation strategies within LANP.

Focus group discussions (FGDs)

FGDs, comprising 6–8 participants each, were facilitated by experienced local researchers to explore shared community norms, collective grievances and cultural values regarding the Park. Guiding questions explored the cultural significance of restricted lands, community-defined thresholds for "fair" policy enforcement and the lived realities of displaced livelihoods. Segregating the FGDs by gender and age ensured that power dynamics did not suppress the voices of women or youth, allowing for a nuanced understanding of how cul-

tural norms mediate policy perceptions (Mack et al. 2005). All qualitative interviews and FGDs were audio-recorded with informed consent and transcribed verbatim for analysis.

Data analysis methods

Qualitative data analysis

Audio recordings from the key informant interviews and focus group discussions were transcribed verbatim and translated into English. The qualitative data were analysed using thematic analysis following Braun and Clarke's (2006) six-phase framework. Using a deductive approach, initial codes were generated, based on the study's conceptual domains (e.g. perceived costs/benefits, formal rules, governance structures and informal norms). These were subsequently refined into broader themes—such as institutional mistrust, livelihood trade-offs and cultural displacement. To ensure rigour and mitigate researcher bias, thematic findings were triangulated against the quantitative survey results (Creswell and Plano Clark 2017).

Quantitative descriptive and bivariate analysis

Quantitative survey data (n = 128) were processed and analysed using STATA statistical software (Version 17). Descriptive statistics (means, frequencies, standard deviations and percentages) were computed to summarise the socio-economic, demographic and institutional profiles of the sampled households. Prior to multivariate regression, bivariate analyses—including Chi-square tests for categorical variables and one-way ANOVA for continuous variables—were conducted to examine the initial associations between the explanatory variables and the dependent variable (perception of policy effectiveness).

Econometric model specification

As the dependent variable—local communities' perception of conservation policy effectiveness—is measured on a five-point ordinal scale (1 = Very ineffective to 5 = Very effective), the ordered logit regression model (OLRM) was selected. Unlike multinomial logistic regression, which ignores the inherent ranking of outcomes or ordinary least squares (OLS), which assumes equal intervals between categories, OLRM is specifically designed for ordinal data and provides statistically efficient estimates (Greene 2018).

The model estimates the probability that a household's perception (Yi) falls at or below a particular category j, given a set of explanatory variables (Xi). The underlying latent variable model is specified as: $Yi*=Xi\beta+\epsilon i$. Here, $Yi*$ is the unobserved latent variable representing the true perception of policy effectiveness, Xi is the vector of explanatory variables, β is the vector of coefficients to be estimated and ϵi is the error term assumed to follow a standard logistic distribution.

The observed ordinal outcome Yi is determined by threshold parameters (cut-points, aj) such that: $Yi = j$ if $aj-1 < Yi* \leq aj$ The log-odds of the perception being at or below category j is modelled as:

$$\ln[P(Yi>j)P(Yi\leq j)] = \alpha j - Xi\beta \quad \text{(Equation 1).}$$

A positive coefficient (β) indicates that an increase in the explanatory variable decreases the log-odds of being in a lower perception category, implying a higher likelihood of perceiving the policy as effective (and vice versa). Results are reported as odds ratios for intuitive interpretation.

Definition and measurement of variables

Explanatory variables were categorised into socio-economic, institutional and demographic control variables (Table 1). Notably, "Wildlife tolerance" (replacing the broad term "Attitude") is included as a mediating socio-psychological factor, though its potential endogeneity with the dependent variable is acknowledged as a limitation.

While the integrated SET-IAD framework identifies cultural factors as a key domain, measuring informal institutions like traditional ecological knowledge quantitatively is inherently complex. In this study, deep cultural variables—such as 'religious/cultural attachment to wildlife' and 'localised beliefs in human-wildlife co-existence'—were not forced into the discrete, ordinal categories required for the Ordered Logit Regression Model (Table 1). Instead, these cultural dimensions were captured through specific survey questions analysed via bivariate correlations to map their empirical relationships and were deeply explored through the qualitative FGDs and KIIs to understand the mechanisms behind them.

Diagnostic tests

To ensure the robustness of the OLRM estimates, two primary diagnostic tests were conducted. First, multicollinearity amongst the independent variables was assessed using the variance inflation factor (VIF). A VIF value exceeding 10 (corresponding to an $R^2 > 0.90$ in the auxiliary regression) was set as the

Table 1. Definition, measurement and expected signs of explanatory variables.

Theoretical domain	Variable	Description & Coding	Expected sign
Dependent variable	Perception of policy effectiveness	Ordinal: 1=Very ineffective, 2=Ineffective, 3=Neutral, 4=Effective, 5=Very effective	-
SET variables	Resource dependence	Frequency of extracting park resources (0=None, 1=Occasional, 2=Frequent)	–
	Human-wildlife conflict (HWC)	Experience of crop/livestock damage (0=No, 1=Yes)	–
	Livestock holding	Total tropical livestock units (TLU) owned	–
	Land size	Total farmland size (in hectares)	+
	Monthly income	Total household income in ETB (log-transformed)	+
	Distance to park	Euclidean distance from household to park boundary (km)	+
IAD variables	Decision-making inclusion	Participation in park conservation decisions (0=No, 1=Yes)	+
	Park authority conflict	History of disputes with park management (0=No, 1=Yes)	–
	Land tenure security	Perceived security of land ownership (0=Insecure, 1=Secure)	+
	Benefit-sharing perception	Perception of fairness in park benefit distribution (0=Poor, 1=Good)	+
Controls	Age	Age of household head (in years)	+/–
	Sex	Gender of household head (1=Male, 0=Female)	+/–
	Education	Years of formal schooling completed	+
	Wildlife tolerance	Willingness to co-exist with wildlife (0=Negative, 1=Positive)	+

threshold for severe collinearity (Gujarati 2004). Second, the critical assumption of the OLRM—the parallel lines assumption (proportional odds)—was tested using the Brant test (Williams 2006). If the assumption was violated for specific variables, a generalised ordered logit model (GOLM) was considered as a robustness check to allow coefficients to vary across outcome categories.

Ethical consideration

This study strictly adhered to the ethical principles for social science research involving human subjects. The research protocol was formally reviewed and approved by the Institutional Review Board (IRB) of Hawassa University, Wondo Genet College of Forestry and Natural Resources.

Prior to data collection, informed consent was secured from all participants following a standardized protocol designed to accommodate varying literacy levels. The objectives, scope, potential risks and anticipated benefits of the research were clearly explained verbally in the local languages (Sidaamu Afoo and Amharic). Verbal consent was obtained (Marshall and Batten 2004). All participants were explicitly informed of their absolute right to refuse to answer any question or to withdraw from the study at any time without penalty or loss of any services.

To ensure confidentiality and anonymity, all personally identifiable information (e.g. names and precise household GPS coordinates) was removed during data processing and replaced with unique alphanumeric codes. Audio recordings from KIIs and FGDs were transcribed verbatim. As the study investigated potentially sensitive issues—including illegal resource extraction, human-wildlife conflict and active disputes with park authorities—particular care was taken to mitigate potential social or political risks to participants. Interviews and FGDs were conducted in private, neutral locations to prevent eavesdropping by local authorities. Furthermore, during FGDs, facilitators were trained to actively manage power dynamics—such as the presence of local elites or gender hierarchies—ensuring that marginalised voices (particularly women and youth) could express dissenting views or grievances regarding park management without fear of social reprisal (Mack et al. 2005).

Results

Demographic and socio-economic profiles

The survey data (n = 128) reveal distinct socio-demographic patterns amongst households adjacent to Loka Abaya National Park. Male-headed households dominate the sample (mean age = 36.99 years), while female-headed households are notably younger (mean age = 29.43 years). Married respondents represent the majority, reporting the longest mean residency (37.55 years) and the largest average family size (6.23 members). Educational attainment exhibits an inverse relationship with age and family size: households with no formal education had a mean age of 42.66 years and family size of 6.62, whereas diploma holders/high school and 2 years' college education averaged 29 years of age and a family size of 3.00. Widowed respondents demonstrated the largest family sizes (mean = 8.00) and longest residency (43 years) (Table 2).

Table 2. Demographic characteristics of surveyed households in Loka Abaya National Park and their potential implications for conservation.

Variable	Category	Mean age (years)	Mean years of residency	Mean family size
Sex	Male	36.99	36.99	5.93
	Female	29.43	29.43	4.86
Marital status	Single	22.00	22.00	1.00
	Married	37.55	37.55	6.23
	Divorced	–	–	–
	Widowed	43.00	43.00	8.00
Educational level	No formal education	42.66	42.66	6.62
	Grade 1–8	35.19	35.19	6.23
	Grade 9–10	28.50	28.50	3.00
	Grade 11–12	21.00	21.00	1.67
	Diploma or above	29.00	29.00	3.00

Livelihood strategies

Livelihood portfolios were found to be heavily skewed towards land-based activities. Cereal crop farming was the primary livelihood for 58 respondents (45.3%), followed by agro-pastoralism (36 respondents, 28.1%). Mixed crop-livestock agriculture ranked third overall, but dominated the secondary and tertiary livelihood ranks (Table 3). Off-farm labour, private business and government/NGO aid were functionally negligible; 125 respondents ranked off-farm labour as their absolute lowest livelihood option. Cash crop production (coffee/chat) showed moderate integration, but remained marginal compared to subsistence grains.

Resource dependence and accessibility

Despite strict prohibitions under Ethiopian Wildlife Proclamation No. 541/2007, reliance on Park resources was found to be high. The primary resources extracted included firewood and grass for cattle (45.3% of respondents), wood for construction (14.1%) and grass alone (10.2%) (Table 4). Furthermore, 86.7% of respondents perceived that local resources have become more accessible due to the Park's presence, while only 13.3% disagree. As households frequently extract multiple resources simultaneously, respondents were allowed to select

Table 3. Ranking of livelihood sources amongst local communities near Loka-Abaya National Park (n=128, own survey, 2024).

Livelihood source	Ranks (% of respondents)						
	1st	2nd	3rd	4th	5th	6th	Total
Cereal crop farming	58	37	21	9	1	1	128
Agro-pastoral/livestock rearing	36	54	14	17	1	6	128
Mixed (crop & animal) agriculture	20	24	75	1	3	4	128
Coffee/chat/fruit grower	10	13	11	17	44	33	128
Off-farm labour/daily labour	3	0	0	0	0	125	128
Spices/tuber grower	0	0	0	1	0	127	128
Private business/trade	0	1	0	1	3	121	127
Government employee	0	0	0	0	1	125	127
Government/NGO aid	0	0	3	0	0	124	127

Table 4. Accessibility of park resources for local livelihoods in Loka Abaya National Park, Ethiopia (n = 128).

Park resources accessible	Frequency	Percent
Grass for cattle	13	10.2
Fire wood and grass for cattle	58	45.3
Firewood, grass for cattle and medicinal plants	1	0.8
Construction wood only	18	14.1
Grass and construction wood	9	7
Grass, medicinal plant and wood	9	7.0
Wood, grass and plants	1	0.8
Other / Missing	19	14.8
Total	**128**	**100.0**

all applicable options. Table 4 presents the distinct combinations of resources extracted, with a clear distinction made between firewood (for energy) and wood (for construction).

Qualitative findings: Gendered and generational perspectives

Thematic analysis of the FGDs revealed distinct divergences between demographic cohorts. Male and female elders predominantly framed the Park through a lens of cultural loss and immediate livelihood threat. Elder participants emphasised historical access to grazing and medicinal plants, with female elders specifically highlighting the increased daily burden of travelling further to collect fuelwood and water due to Park restrictions. Notably, female elders were identified as the primary custodians of traditional ecological knowledge regarding specific medicinal plants and indigenous wildlife behaviour, suggesting that restrictive park boundaries disproportionately marginalise women's cultural heritage and practical knowledge systems.

Conversely, FGDs with male and female youth yielded markedly different perceptions. Aligning with the survey data showing smaller family sizes and higher educational attainment amongst younger demographics, youth participants expressed less reliance on direct resource extraction. While they acknowledged household hardships, youth cohorts were significantly more positive towards the Park's existence, frequently citing the potential for future ecotourism jobs and environmental protection. Youth also expressed frustration with what they perceived as the "outdated" resistance of elders, indicating a generational shift in how the Park's value is calculated.

Bivariate and correlation analysis

An ANOVA test indicated no statistically significant differences in the mean distance from the Park across different types of resources accessed ($F = 2.295$, $df = 3$, $p = 0.087$). A binary logistic regression assessing predictors of support for wildlife protection laws indicated that education significantly predicted support (score = 4.607, $p = 0.032$) while annual income did not (score = 1.845, $p = 0.174$).

Pearson correlation analysis (Table 5) revealed strong associations amongst socio-cultural variables. Distance from the Park was found to be negatively correlated with the belief that human-wildlife conflict (HWC) can be managed

Table 5. Pearson correlation matrix of socio-cultural variables and conservation attitudes amongst Loka Abaya National Park communities (n = 128).

Variables	Distance from Park (hrs)	Perception becoming positive over time	Conflict with wild animals can be managed	Knows how to live in harmony with wild animals	Aware habitat loss needs preservation	Supports legal protection of wild animals	Religious/cultural attachment to certain wild animals
Distance from Park (hrs)	1	.081	-.428**	.204	.396**	.050	-.354**
χ^2	-	.448	.000	.054	.000	.643	.001
Perception becoming positive over time	.081	1	.003	.126	.150	.091	-.225*
χ^2	.448	-	.978	.238	.158	.393	.033
Conflict with wild animals can be managed	-.428**	.003	1	-.391**	-.831**	-.123	.768**
χ^2	.000	.978	-	.000	.000	.248	.000
Knows how to live in harmony with wild animals	.204	.126	-.391**	1	.368**	.000	-.262*
χ^2	.054	.238	.000	-	.000	1.000	.013
Aware habitat loss needs preservation	.396**	.150	-.831**	.368**	1	.187	-.746**
χ^2	.000	.158	.000	.000	-	.078	.000
Supports legal protection of wild animals	.050	.091	-.123	.000	.187	1	-.230*
χ^2	.643	.393	.248	1.000	.078	-	.029
Religious/cultural attachment to certain wild animals	-.354**	-.225*	.768**	-.262*	-.746**	-.230*	1
χ^2	.001	.033	.000	.013	.000	.029	-

($r = -0.428$, $p < 0.01$) and negatively correlated with cultural attachment to wildlife ($r = -0.354$, $p < 0.01$). Conversely, distance was positively correlated with awareness of habitat loss ($r = 0.396$, $p < 0.01$). Notably, the perception that HWC is manageable was strongly positively correlated with cultural attachment to wildlife ($r = 0.768$, $p < 0.01$) and strongly negatively correlated with awareness of habitat loss ($r = -0.831$, $p < 0.01$).

Econometric analysis of policy perception

Prior to regression, variance inflation factor (VIF) tests confirmed an absence of multicollinearity, with a mean VIF of 1.28 (Table 6). Although a Brant test indicated a violation of the proportional odds assumption—suggesting that a generalised ordered logit model would be statistically optimal—the results from a standard ordered logit regression model are presented below as a baseline to indicate variable directionality and magnitude. The OLRM is statistically significant (χ^2 (14) = 72.38, $p < 0.001$) with a Pseudo R^2 of 0.2212 (Table 7).

The OLRM results indicated that higher income ($p = 0.001$), greater distance from the Park ($p = 0.005$), larger land size ($p = 0.028$), involvement in decision-making ($p = 0.003$) and conflict with Park authorities ($p = 0.037$) positively and significantly influence the likelihood of perceiving conservation policy as effective.

Conversely, larger household size ($p = 0.004$), higher economic interaction with the Park ($p = 0.002$) and secure land tenure ($p = 0.021$) significantly decrease the likelihood of perceiving policies as effective. Education exhibited a weakly significant positive effect at the 10% level ($p = 0.058$), while sex, HWC experience, resource access and wildlife attitudes showed no statistically significant impact.

Table 6. Variance inflation factor results for explanatory variables used in the ordered logistic regression model.

Variable	VIF	1/VIF
Age	1.81	0.551273
Household size	1.75	0.571901
Decision-making involvement	1.43	0.698964
Distance to the Park	1.26	0.792171
Income	1.26	0.794996
Attitude to wildlife	1.25	0.798304
Education	1.24	0.804778
Land size	1.17	0.852835
Economic interaction	1.16	0.865116
Resource access	1.14	0.878725
Land tenure	1.13	0.885553
Conflict with park authority	1.12	0.893390
Sex	1.08	0.927656
Human to wildlife conflict	1.06	0.946925
Mean VIF	1.28	

Table 7. Ordered logistic regression results on determinants of local communities' perception of policy effectiveness.

Log likelihood = – 127.41116			**Number of obs = 128**		
			LR chi2(14) = 72.38		
			Prob > chi2 = 0.0000		
			Pseudo R2 = 0.2212		
Variables	Coef.	Std. Err.	z	P>z	Odds ratio
Age	.0235855	.0197046	1.20	0.231	1.02
Sex	-1.087387	.6200175	-1.75	0.079	0.34
Income	.0000152	4.44e-06	3.43	0.001	1.00
Household size	-.3305334	.1159799	-2.85	0.004	0.72
Distance to the Park	.4851393	.1741365	2.79	0.005	1.62
Education	.0977273	.0516209	1.89	0.058	1.10
Human to wildlife conflict	.4036484	.4485152	0.90	0.368	1.50
Conflict with Park authority	1.047867	.5017273	2.09	0.037	2.85
Economic interaction	-1.301345	.4241708	-3.07	0.002	0.27
Decision-making involvement	1.486062	.5060643	2.94	0.003	4.42
Resource access	.3532862	.3260762	1.08	0.279	1.42
Attitude to wildlife	.1148877	.4977777	0.23	0.817	1.12
Land Size	.2077127	.0942753	2.20	0.028	1.23
Land tenure	-1.008371	.4366942	-2.31	0.021	0.36
/cut1	1.76243	1.251013			
/cut2	2.565374	1.263739			
/cut3	3.627897	1.286322			
/cut4	5.240459	1.352603			

Values are given in parentheses. ***Indicates significance at 1% level. **Indicates significance at 5% level. *Indicates significance at 10% level.

Discussion

This study set out to identify the socio-economic, institutional and cultural determinants shaping local communities' perceptions of conservation policy effectiveness in Loka Abaya National Park. Utilising an integrated Social

Exchange Theory and Institutional analysis and development framework, the findings reveal that policy perceptions are not static; rather, they are actively negotiated through household-level cost-benefit analyses and lived experiences with formal and informal governance structures. As global conservation accelerates toward the "30 × 30"/ protecting 30% of the Earth's land and oceans by the year 2030 target under the Kunming-Montreal Global Biodiversity Framework, understanding these local perception dynamics is critical to avoiding the replication of coercive conservation models (Borrini-Feyerabend et al. 2022; Dudley et al. 2023).

The livelihood-conservation paradox and the cost-benefit analysis (SET lens)

From an SET perspective, support for conservation is contingent on perceived benefits outweighing costs. The demographic and livelihood data reveal a highly vulnerable population base trapped in a "subsistence dependence" loop. The significant negative impact of household size on policy perception (Odds Ratio = 0.72) perfectly illustrates this dynamic. Larger families require proportionally more fuelwood, grazing land and space for agriculture, meaning conservation restrictions impose a disproportionately high daily subsistence cost on them. This aligns with recent empirical evidence from East Africa, where rapid population growth and large household sizes directly correlate with increased environmental extraction to meet basic caloric and energy needs (Muller and Darras 2023).

Similarly, the strongly negative coefficient for "economic interaction" (OR = 0.27) exposes a critical flaw in the Park's local integration. In an ideal SET scenario, economic interaction should yield positive benefits (e.g. ecotourism jobs and revenue sharing). However, in LANP, "economic interaction" functions as a proxy for extractive, illegal reliance (e.g. unauthorised grazing and firewood collection) due to a total absence of formal alternative livelihoods. This forces households into a shadow economy that inherently positions them in conflict with the State, souring their perception of policy effectiveness. Recent studies emphasise that, without purposeful livelihood diversification—moving communities from pure resource extraction to conservation-linked enterprises—protected areas merely act as poverty traps (Coolsaet et al. 2022). Conversely, the positive impact of absolute household income supports the classical SET assumption: wealthier households are insulated from the harsh costs of restricted access and are more likely to perceive policies favourably (Rasheed et al. 2022).

Spatial dynamics and the "proximity penalty"

Increasing distance from the Park significantly increases the likelihood of positive policy perceptions (OR = 1.62), a phenomenon well-documented in literature as spatial injustice in conservation (Ingco et al. 2023). Households bordering LANP bear the localised brunt of human-wildlife conflict (HWC)—such as crop raiding and livestock depredation—while distant households enjoy the ecological buffer of the Park (e.g. water regulation) without paying the daily behavioural costs.

Interestingly, the ANOVA results showed no significant spatial variation in the type of resources accessed (p = 0.087). This suggests that resource scarcity is so acute in the wider landscape that even distant households travel to the Park. Yet, because they do not suffer daily HWC, their overall assessment of the policy remains higher. This finding reinforces recent calls by scholars such as Dickman et al. (2021), who argue that, if the spatial distribution of PA costs (HWC, restricted access) is not actively mitigated through targeted compensation or fencing, it will invariably breed localised resistance, regardless of the Park's broader ecological success.

Institutional governance and anomalous findings (IAD lens)

The IAD framework posits that institutional rules, governance structures and actor interactions shape the "action arena". Unsurprisingly, involvement in decision-making strongly positively influences perceptions (OR = 4.42). This validates recent global consensus that perceived procedural justice—giving communities a genuine voice—fosters institutional trust and policy legitimacy (Bennett et al. 2019; Kumar and Routray 2022).

However, two institutional variables yielded counter-intuitive results that require deep theoretical unpacking. First, "Conflict with park authorities" positively predicted perceived policy effectiveness (OR = 2.85). Rather than indicating that communities appreciate conflict, this finding is best understood through the lens of State presence and institutional visibility. In highly marginalised rural landscapes where state capacity is often absent, interaction—even hostile or coercive interaction—demonstrates that the policy has tangible, observable effects on the ground. Recent literature on "authoritarian environmentalism" and militarised conservation in Africa notes that local communities often conflate the enforcement capacity of an institution with its effectiveness (Massé 2022; Duffy et al. 2023). Thus, households in conflict with rangers recognise the State's power to enforce boundaries, rating the policy as "effective" in its primary goal of nature protection, even as they resent its socio-economic impacts.

Second, "secure land tenure" negatively predicted policy effectiveness (OR = 0.36). This contradicts dominant global narratives suggesting that secure tenure promotes environmental stewardship (Pelletier et al. 2021). However, it aligns perfectly with recent empirical findings in Ethiopian and East African PAs (Kafumbi et al. 2022). In LANP, households with secure land tenure outside the Park likely view strict conservation policies as an unjust barrier to their legally recognised right to expand agriculture or access adjacent resources. For them, secure tenure amplifies the perceived injustice of exclusionary boundaries. Conversely, landless or tenure-insecure households may view the Park's fixed boundaries as a neutral baseline or they may strategically support the Park in hopes of future benefit-sharing or land redistribution.

Socio cultural mediators and knowledge systems

The correlation matrix highlights a profound tension between indigenous ecological knowledge and modern Western conservation narratives. The strong negative correlation between cultural attachment to wildlife and awareness of

habitat loss (r = – 0.746) suggests that communities with strong traditional ties to wildlife do not frame their local reality through the scientific paradigm of "habitat degradation". Instead, their cultural connection fosters a localised belief that human-wildlife co-existence is inherently manageable (r = 0.768). This finding echoes recent IPBES Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) assessments, which warn that top-down PAs often marginalise indigenous and local knowledge (ILK), replacing it with rigid, exclusionary scientific paradigms that alienate local populations (Brondizio et al. 2021). Furthermore, the positive impact of education on policy perception supports the necessity of bridging these knowledge systems. Education increases a household's cognitive flexibility, allowing the household to understand abstract, long-term biodiversity benefits over immediate, short-term extraction needs (Kumari et al. 2023).

The comparative FGD analysis reveals a critical, often overlooked dynamic in PA conflicts: the generational divergence in policy perceptions. The qualitative data supports a "positive time perspective", wherein the youth—benefitting from higher education and smaller household dependencies—are more receptive to conservation paradigms than their elders. This aligns with the quantitative finding that education positively influences policy perception. Furthermore, the FGDs highlighted that women, particularly elder women, act as the primary stewards of cultural values and indigenous ecological knowledge regarding forest resources. Current exclusionary policies, therefore, threaten not just economic livelihoods, but matriarchal knowledge transfer.

These findings point to a promising, yet underutilised, conservation strategy: reverse learning (intergenerational knowledge transfer from youth to parents). As youth are more literate and understand the long-term ecological and economic benefits of the Park, they can act as bridging agents within their households. We recommend that future PA management strategies in LANP explicitly design "youth-to-parent" environmental education programmes. By equipping youth with conservation knowledge and alternative livelihood skills, policy-makers can foster organic household-level dialogues that gradually shift elder resistance into collaborative co-management, while simultaneously ensuring that women's traditional ecological knowledge is integrated into park stewardship rather than erased by it.

Methodological limitations

It is important to acknowledge that the Brant test indicated a violation of the proportional odds assumption in the ordered logit model. This suggests that the effect of certain predictors (e.g. income or conflict) is not strictly constant across the entire spectrum of perception categories (e.g. moving from "Very ineffective" to "Ineffective" may be driven by different factors than moving from "Effective" to "Very effective"). Future research should employ generalised ordered logit models to capture these category-specific nuances. Additionally, the cross-sectional design limits our ability to infer strict causality.

A notable methodological limitation of this study is the asymmetrical implementation of its conceptual framework. While the framework integrates socio-economic, institutional and cultural domains, the primary econometric model (OLRM) robustly captured SET (cost-benefit) and IAD (institutional) vari-

ables, but could not adequately quantify the nuanced 'cultural' pillar. As cultural values—such as traditional ecological knowledge and spiritual attachments to wildlife—do not easily reduce to Likert-scale variables, they were relegated to bivariate correlations and qualitative exploration. Future research should develop and validate specific quantitative scales for informal cultural institutions to better integrate them into multinomial regression models, ensuring that the 'cultural' domain carries equal statistical weight in perception analyses.

Conclusion and policy implications

Perceptions of conservation policy effectiveness in LANP are structurally constrained by a lack of livelihood alternatives and top-down, exclusionary governance. As Ethiopia and the broader African continent expand their PA networks to meet global 2030 targets, replicating the LANP model in its current form risks deepening poverty and conflict. To reconcile biodiversity goals with livelihood needs, PA management must transition from punitive "fortress conservation" to integrated, rights-based co-management. This requires: (1) Establishing genuine, predictable benefit-sharing mechanisms (e.g. ecotourism revenue) to convert negative "economic interactions" into positive incentives; (2) Implementing community-led buffer zone management that explicitly respects local land tenure rights rather than undermining them; (3) Designing environmental education programmes that bridge traditional ecological knowledge with modern conservation science, thereby reducing the perceived costs for large, land-dependent households; and (4) Designing intergenerational 'reverse learning' programmes that leverage the conservation-positive attitudes of educated youth to influence household perceptions, while explicitly integrating the traditional ecological knowledge of women into Park management plans.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

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Data availability

All of the data that support the findings of this study are available in the main text.