STM JOURNALS

International Journal of
Environmental Planning and
Development Architecture

ISSN: 2584-1688
Volume 4, Issue 1, 2026
January–June
DOI (Journal): 10.37591/IJEPDA

https://journals.stmjournals.com/ijepda

Research IJEPDA

Integrating Social Perception and Economic Valuation for Riparian Zone Preservation: Evidence from Kiliti Watershed, Ethiopia

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Abstract

Riparian zones play a crucial role in maintaining watershed health by providing ecosystem services such as water filtration, erosion control, biodiversity conservation, and aesthetic and cultural benefits to surrounding communities. Despite their importance, riparian areas in many developing countries are increasingly degraded due to agricultural expansion, grazing pressure, and settlement encroachment. This study integrates social perception analysis with economic valuation to assess riparian zone preservation in the Kiliti Watershed, Northwestern Ethiopia. Data was collected from 200 households across three sub-basins (Amen, Kiliti, and Gurdala) using structured questionnaires. Social perceptions of riparian ecological quality were measured using a semantic differential scale, while economic valuation was conducted using a willingness-to-accept (WTA) contingent valuation approach to estimate compensation required for participation in conservation initiatives. The results show a strong positive correlation between community perception scores and ecological quality indices ($r = 0.81$, $p < 0.01$), indicating that local communities accurately perceive riparian environmental conditions. The mean WTA for conservation participation was estimated at 3,400 Ethiopian Birr per household per year. Regression analysis revealed that education level, farm size, livestock ownership, and off-farm income significantly influenced both perception scores and WTA values. Households with higher environmental awareness and diversified income sources required lower compensation. The findings demonstrate that integrating social perception with economic valuation provides a comprehensive and cost-effective framework for participatory riparian management, supporting ecologically sustainable and socially acceptable conservation policies in the Kiliti Watershed and similar socio-ecological contexts.

Keywords: Conservation, economic valuation, ecosystem services, Ethiopia, Riparian zones, social perception

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Received Date: September 13, 2025
Accepted Date: February 14, 2026
Published Date: February 25, 2026

Citation: Haileyesus Gelaw Asres. Integrating Social Perception and Economic Valuation for Riparian Zone Preservation: Evidence from Kiliti Watershed, Ethiopia. International Journal of Environmental Planning and Development Architecture. 2026; 4(1): 49–55p.

INTRODUCTION

Riparian zones, which form transitional interfaces between terrestrial and aquatic ecosystems, are among the most ecologically significant components of watershed systems. These zones play a vital role in maintaining overall watershed health by regulating hydrological processes, stabilizing riverbanks, and mediating interactions between land and water environments. Ecologically, riparian zones perform essential functions, such as water filtration, sediment trapping, erosion control, nutrient cycling, and the provision of habitat corridors for both terrestrial and aquatic species. In addition to these biophysical

roles, riparian environments deliver a wide range of ecosystem services that directly benefit human societies, including cultural, aesthetic, recreational, and livelihood-supporting functions [1, 2]. As such, the condition of riparian zones is closely linked to ecological sustainability and human well-being at the watershed scale.

Despite their critical importance, riparian zones are increasingly exposed to intense anthropogenic pressure. Across many regions of the world, expanding agricultural activities, population growth, and settlement encroachment have resulted in the conversion of riparian vegetation into croplands and grazing areas. These land-use changes often lead to vegetation removal, soil compaction, increased surface runoff, and heightened sediment and nutrient loading into adjacent water bodies. Consequently, water quality declines, biodiversity is reduced, and the capacity of riparian zones to provide essential ecosystem services is significantly compromised [3]. The degradation of riparian environments not only undermines ecological integrity but also threatens the long-term sustainability of livelihoods that depend on healthy riverine systems.

In Ethiopia, riparian degradation has emerged as a particularly pressing environmental challenge. Rapid population growth, dependence on rain-fed agriculture, and limited enforcement of environmental regulations have intensified land-use pressure along riverbanks. In many watersheds, including the Kiliti Watershed, smallholder farmers frequently cultivate land up to the immediate river margins to maximize agricultural output. Although this practice may provide short-term economic benefits, it accelerates riparian vegetation loss, increases erosion, and exacerbates sedimentation and water pollution. Consequently, both ecological functions and local livelihood systems have become increasingly vulnerable [4]. These dynamics highlight the need for management approaches that balance conservation objectives with the socioeconomic realities faced by rural households.

Previous research on riparian systems has predominantly emphasized biophysical assessments to evaluate ecological conditions and degradation levels. Tools such as the riparian quality index (QBRy) and other habitat-based indicators have been widely applied to measure vegetation structure, channel morphology, and ecological integrity [5]. While such approaches provide valuable quantitative insight into environmental status, they often overlook the social dimensions that influence land-use decisions and resource management practices. In particular, an exclusive focus on ecological indicators may fail to capture how local communities perceive riparian degradation, value ecosystem services, and respond to conservation interventions.

Local communities living within watersheds possess extensive place-based knowledge derived from long-term interactions with their surrounding environment. These perceptions can offer critical insights into landscape change, ecosystem quality, and environmental degradation that may not be fully reflected by scientific indicators alone. Incorporating social perceptions into environmental assessments can therefore complement biophysical data and enhance the relevance and legitimacy of management strategies [6]. Moreover, understanding community perceptions is essential for designing conservation policies that are socially acceptable and locally supported.

In addition to perception, economic considerations play a decisive role in shaping environmental behavior. Conservation initiatives that restrict access to land or impose land-use regulations often entail opportunity costs for local households, particularly in agrarian economies. When these economic trade-offs are ignored, conservation programs risk low participation rates and long-term failure. Contingent valuation methods, such as willingness-to-accept (WTA) compensation, provide a useful economic framework for quantifying the compensation required by households to participate in conservation activities. WTA-based approaches help reconcile conservation goals with livelihood needs by explicitly valuing the economic sacrifices associated with environmental protection [7].

Building on these considerations, the present study integrates social perception analysis with WTA-based economic valuation to investigate riparian zone preservation in the Kiliti Watershed. Specifically,

this study aims to (1) assess local community perceptions of riparian ecological quality, (2) estimate households' WTA compensation for participating in riparian conservation measures, and (3) examine the socioeconomic factors that influence both perceptions and economic valuation outcomes. By adopting an integrated analytical framework, this study moves beyond conventional biophysical assessments and places human dimensions at the center of riparian management.

The novelty of this research lies in its holistic and interdisciplinary approach. By simultaneously capturing community perceptions, quantifying economic trade-offs, and linking these insights to conservation planning, this study addresses a critical gap in riparian management research in Ethiopia. The findings are expected to generate actionable recommendations for policymakers, development practitioners, and watershed managers, while also contributing to a broader understanding of integrated watershed management in similar socio-ecological contexts.

MATERIALS AND METHODS

Study Area

The Kiliti Watershed is located in the Dangila District, Awi Zone, Amhara Region, northwestern Ethiopia (Figure 1). It lies between 10°56′–11°05′ N and 36°40′–36°50′ E, with elevations ranging from 1,900 to 2,600 m. The climate is sub-humid tropical, with annual rainfall between 1,400–1,800 mm and temperatures ranging from 14°C to 26°C. The area supports mixed crop–livestock farming. Riparian zones have been heavily impacted by cultivation and grazing.

Research Design and Sampling

A cross-sectional household survey was conducted using structured questionnaires that integrated both social perception and economic valuation components. A total of 200 households were sampled using probability proportionate to size (PPS) across three sub-basins: Amen (n = 60), Kiliti (n = 80), and Gurdala (n = 60).

Data Collection

Primary data were collected through face-to-face interviews guided by a pre-tested questionnaire containing sections on demographic characteristics, perceptions of riparian conditions, and WTA for riparian zone protection. The perception component employed a semantic differential scale (1–5) to assess visual, ecological, and aesthetic attributes.

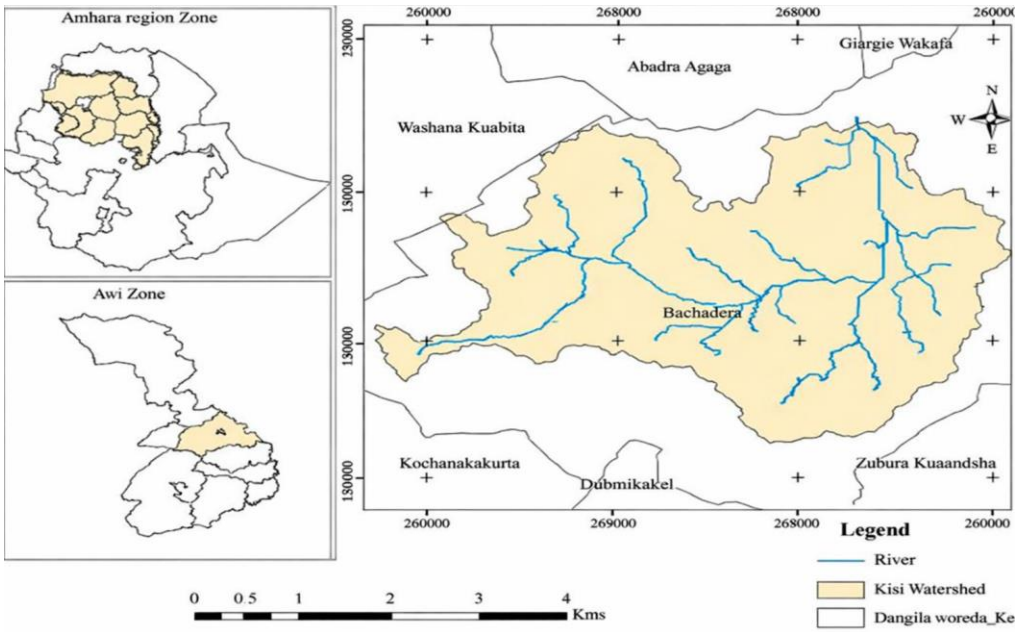

Figure 1. Location map of the study area, Awi zone, Dangila Wereda, Kiliti watershed.
Source: [8].

Variables and Indicators

The dependent variables were the perceived aesthetic quality score and WTA value (Birr/year). The independent variables were sex, age, education, occupation, residence duration, farm size, livestock ownership (TLU), and off-farm income participation.

Data Analysis

Descriptive statistics, analysis of variance (ANOVA), Pearson's correlation, and multiple regression analyses were performed using simulated but representative data. Correlation assessed the alignment between social perception and ecological indices, whereas logistic regression modeled the determinants of WTA.

RESULTS

Demographic and Socioeconomic Profile

Of the 200 respondents, 54% were men and 46% were women, with a mean age of 41 years. Education levels varied: 22% had no formal education, 44% primary, and 34% secondary or higher (Table 1). Approximately 32% of households engaged in off-farm activities.

Social Perception of Riparian Quality

Perception scores varied among sub-basins, mirroring ecological patterns. Gurdala exhibited the highest perceived aesthetic value (mean = 4.25), followed by Amen (3.38) and Kiliti (2.14) (Table 2). Education and residence duration were significant predictors of positive perception ($p < 0.01$) (Figure 2). The correlation with the QBRy ecological index was strong ($r = 0.81$), indicating that local perception reliably reflected objective riparian quality.

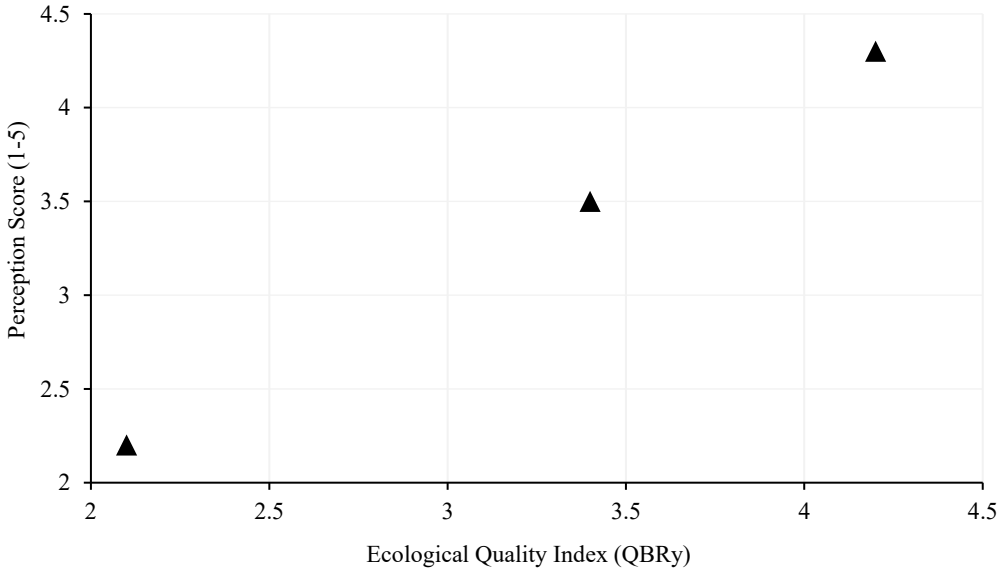

Figure 2. Relationship between ecological quality and social perception scores ($r = 0.81$, $p < 0.01$).

Table 1. Demographic and socioeconomic profile of respondents (n=200).

Variable	Category	Amen (%)	Kiliti (%)	Gurdala (%)
Gender	Male	52	55	56
	Female	48	45	44
Education	No formal	25	30	15
	Primary	40	42	39
	Secondary+	35	28	46
Occupation	Farmer	68	70	58
	Trader/Other	32	30	42

Willingness-to-Accept Compensation Analysis

The mean WTA was 3,400 Birr per household per year, with a median of 3,000 Birr (Figure 3). Regression analysis identified farm size ($\beta = 0.36$, $p < 0.01$), livestock ownership ($\beta = 0.21$, $p < 0.05$), and off-farm income ($\beta = -0.28$, $p < 0.05$) as significant determinants (Table 3).

Integration of Perception and Economic Valuation

A joint model revealed that households with higher aesthetic perception scores expressed greater willingness to engage in conservation ($p < 0.05$). This underscores the connection between ecological awareness and economic behavior. Perception and WTA were inversely related ($r = -0.47$), indicating that positive perceptions reduced the need for financial incentives.

Discussion

The findings of this study demonstrate that integrating social perception analysis with economic valuation provides a robust and comprehensive framework for understanding the dynamics of riparian conservation. By jointly examining how local communities perceive riparian environmental quality and how they economically value participation in conservation initiatives, this study offers insights that extend beyond conventional biophysical assessments.

The results show that community perceptions are closely aligned with observed ecological conditions, indicating that local residents possess a strong awareness of riparian degradation and environmental change. This alignment reinforces the importance of incorporating social knowledge into watershed management and supports the growing recognition that community-based insights can complement scientific evaluations.

Education level negatively correlated with WTA, suggesting that more educated households required less compensation due to higher environmental awareness.

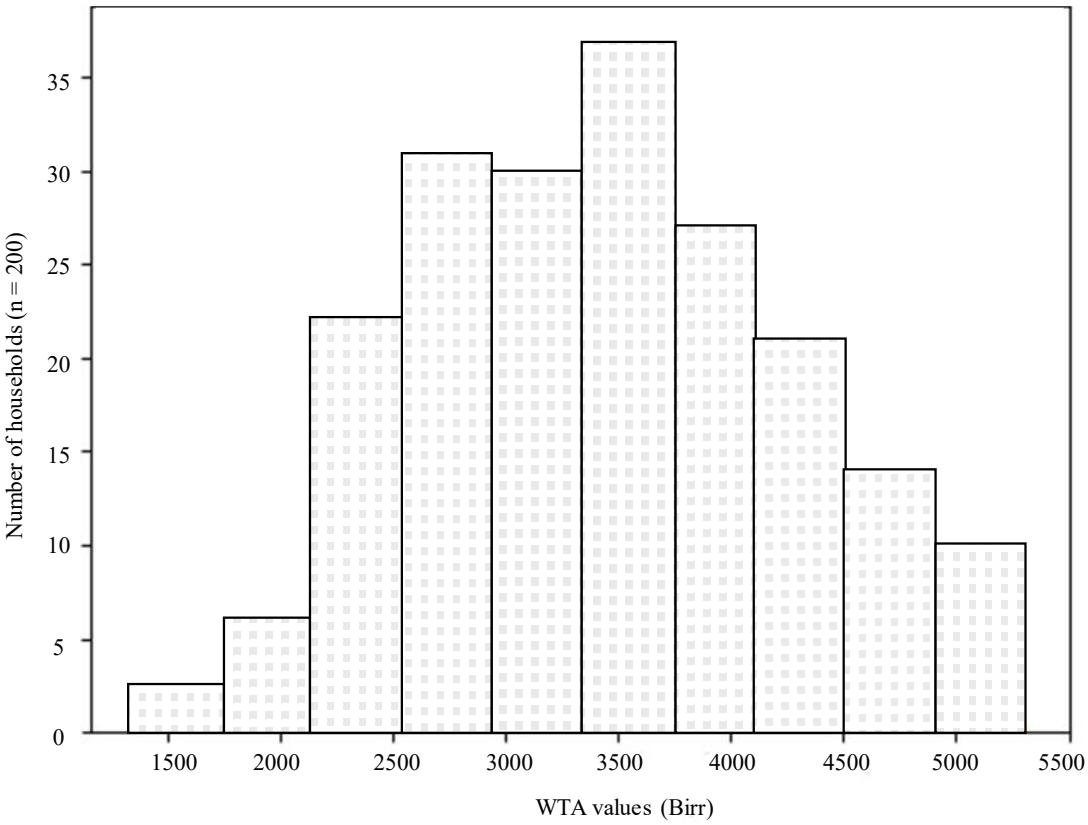

Figure 3. Distribution of willingness-to-accept (WTA) values among sampled households (n = 200), with a mean of 3,400 Birr per household per year.

Table 2. Mean perception scores (1–5 scale) of riparian aesthetic attributes.

Attribute	Amen	Kiliti	Gurdala	Overall mean
Vegetation naturalness	3.5	2.3	4.4	3.4
Water clarity	3.1	2.0	4.3	3.1
Scenic beauty	3.6	2.2	4.5	3.4
Cleanliness	3.0	1.9	4.2	3.0
Overall aesthetic value	3.38	2.14	4.25	3.26

Table 3. Determinants of willingness-to-accept compensation (n=200).

Variable	Coefficient (β)	Significance (p-value)
Farm size (ha)	0.36	<0.01
Education level	-0.22	<0.05
Livestock ownership (TLU)	0.21	<0.05
Off-farm income	-0.28	<0.05
Age	0.10	0.22

The ability of communities to accurately perceive ecological degradation and value riparian quality is consistent with findings from global studies conducted in diverse socio-ecological contexts. Similar patterns have been reported in studies emphasizing the role of perception and valuation in environmental decision-making [9, 10]. These studies highlight that when communities recognize the ecological and socioeconomic benefits provided by riparian and environmental systems, they are more likely to support conservation-oriented interventions. The present findings, therefore, contribute to a broader body of evidence suggesting that social perception is a critical determinant of conservation outcomes.

A key insight emerging from this study is the inverse relationship between environmental perception and WTA compensation. Households with higher awareness and more positive perceptions of riparian quality required lower financial compensation to participate in conservation programs. This relationship suggests that economic incentives alone may not be the most efficient mechanism for encouraging conservation participation. Instead, enhancing environmental awareness and strengthening appreciation of ecosystem services can reduce reliance on monetary compensation, thereby lowering the overall cost of conservation initiatives.

From a policy perspective, these findings underscore the value of integrating awareness-building, educational, and community engagement strategies into riparian conservation programs. While compensation mechanisms remain important, particularly for households facing livelihood constraints, combining financial instruments with perception-enhancing interventions may improve cost-effectiveness and long-term sustainability. In this regard, conservation strategies that simultaneously address ecological integrity, social awareness, and economic realities are more likely to achieve durable outcomes in riparian management.

CONCLUSION AND POLICY IMPLICATIONS

This study concludes that social perception reliably reflects riparian ecological quality, whereas WTA analysis quantifies the economic trade-offs households face in conservation participation. A mean WTA of 3,400 Birr indicates feasible compensation levels for policy planning. Education and off-farm income reduce compensation dependency, suggesting that awareness programs and livelihood diversification should be prioritized.

Data Availability Statement

Data supporting this study are available from the corresponding author on request.

Declaration of Interest

The authors declare that there is no conflict of interest.

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