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Original Research

Exploring the Determinants of Biodiversity Finance Scheme Adoption in Western Oromia, Ethiopia

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Abstract

The decline in biodiversity necessitates sustainable strategies to conserve ecosystems, species, and genetic diversity, which require substantial financial resources. Biodiversity financing presents a potential solution; however, its implementation encounters considerable obstacles. This study examined the determinants of biodiversity finance adoption against seven themes: financial, economic, institutional, environmental, social, conceptual, and skilled personnel, using questionnaire data from 176 key stakeholders in four zones of Wollega Zones, Western Oromia, Ethiopia. The findings suggest that the major challenges to biodiversity finance adoption include a lack of conceptualization, economic and political instability, inadequate funding, social injustice, environmental deregulation, and excessive use of natural resources. The results indicate that financial limitations ($\beta = 0.475$, $p < 0.001$) represent the most significant challenge, followed by economic discouragements ($\beta = 0.297$, $p < 0.001$) and ecological decline ($\beta = 0.256$). Institutional capacity, skilled personnel, and community participation are critical, yet constraints such as limited technical expertise and institutional frameworks persist. The model demonstrated a strong explanatory power, accounting for 69% of the variation in biodiversity finance implementation ($R = 0.824$, $R^2 = 0.69$; $p < 0.001$). Research highlights the need for a cohesive policy structure, coordinated financial systems, and inclusive financing strategies for conservation in Ethiopia.

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INTRODUCTION

Biodiversity underpins the planet's life-support systems, providing essential ecosystem services such as pollination, water purification, climate regulation, and soil fertility, which sustain human livelihoods and economic activities (Díaz et al., 2019). Yet, global biodiversity is rapidly declining due to deforestation, pollution, hazardous waste, climate change, and carbon emissions. This loss carries substantial economic costs, currently estimated at USD 598–824 billion worldwide, as natural resources and agricultural productivity form the backbone of economic value (OECD, 2020). Urgent restoration and protection efforts, supported by adequate financial resources, are critical to halt biodiversity loss and achieve the Sustainable Development Goals (Khan, 2024).

Developing countries, particularly in Africa, face acute challenges in biodiversity conservation

due to limited institutional, technical, and financial capacities. Reliance on government budgets, donor aid, and multilateral support is often insufficient and unpredictable, despite the region harboring globally significant and threatened species (AfDB, 2021; UNDP, 2020). This highlights the need for innovative, diversified, and sustainable biodiversity finance mechanisms.

Biodiversity finance offers a strategic approach to safeguarding natural resources against environmental degradation and climate change. Though budding and complex intersecting economics, finance, social, and environmental sciences, it aims to mobilize and manage financial resources for sustainable biodiversity management (Karolyi & Tobin-de la Puente, 2023; Khan et al., 2024). Its interdisciplinary nature can pose comprehension challenges for stakeholders, yet it remains critical for linking conservation objectives with financial incentives and investment.

This study empirically examines the determinants of biodiversity finance adoption in Western Oromia, Ethiopia, addressing a key knowledge gap in developing-country contexts. By identifying institutional, financial, and capacity-related drivers and barriers, the findings offer guidance for policymakers, practitioners, and financial institutions to design context-specific biodiversity financing mechanisms that advance national sustainability priorities and the SDGs.

Statement of the problem

Ethiopia, one of the world's 36 biodiversity hotspots, hosts a remarkable range of agroecologies, from deserts and savannas to Afromontane and Afroalpine zones, supporting a rich diversity of unique flora and fauna. However, biodiversity is under severe pressure from deforestation, agricultural expansion, land degradation, overpopulation, and climate change (Tesema et al., 2021). Financial constraints further limit conservation efforts, particularly in regions like Western Oromia, where resources for biodiversity protection are scarce. Despite widespread recognition of its importance, the effectiveness of conservation initiatives in Ethiopia remains poorly understood, and the factors promoting or hindering these measures are underexplored.

Previous studies highlight multiple barriers to effective biodiversity finance. Limited theoretical frameworks and conceptual clarity have contributed to misconceptions, with many practitioners narrowly associating biodiversity finance with instruments like green bonds, ESG funds, or social impact bonds, overlooking its broader potential (Khan et al., 2024). Resource scarcity, perceptions of low financial returns, and political-economic volatility further constrain the adoption of sustainable practices. In addition, inadequate regulatory frameworks and fragmented biodiversity data hinder policy design, valuation, and assessment processes, making it difficult to reliably estimate biodiversity finance flows (Arrow et al., 2014).

Addressing these knowledge gaps is essential, particularly in developing regions like Ethiopia, where adoption of biodiversity finance remains limited (EEFRI, 2020). Identifying and understanding the financial, institutional, and informational barriers is critical to designing effective strategies for biodiversity conservation and ensuring sustainable funding mechanisms.

Research questions

1. How do funding availability and financial incentives affect the willingness to adopt biodiversity finance?
2. To what extent do the perceived economic returns affect stakeholders' readiness to engage in biodiversity finance schemes?
3. How do environmental conditions, ecosystem pressures, and biodiversity status shape adoption?
4. How does the availability of skilled personnel impact adoption?
5. How does stakeholders' understanding of biodiversity finance affect its uptake?
6. How do policy frameworks, government structures, and regulatory clarity influence adoption?

7. How does community awareness affect the adoption of biodiversity finance?

MATERIALS AND METHODS

Description of the study area

The study was conducted in the Western Oromia Regional State across four zones: East, Horro Guduru, West, and Kellem Wallga, located between 8°30' and 10°30' N latitude and 34°30' and 37°00' E longitude (Figure 1). Covering approximately 47,000 km² (BoFED, 2020), the area features diverse agro-ecologies from lowlands to highland plateaus, supporting rich biodiversity. In 2021, over 6.5 million people resided in the region, predominantly smallholder farmers practicing mixed rainfed agriculture, including Coffee arabica, maize, sorghum, barley, and teff, alongside livestock rearing (CSA, 2021). Western Oromia is notable for its moist montane forests, part of the Eastern Afromontane biodiversity hotspot, harboring numerous endemic and endangered species. Key conservation areas include Gergedda Forest, Dhati National Park, and community-managed forests under Participatory Forest Management (PFM) schemes (EFCCC, 2020). However, these ecosystems face increasing threats from logging, agricultural expansion, settlement, and weak enforcement of conservation policies.

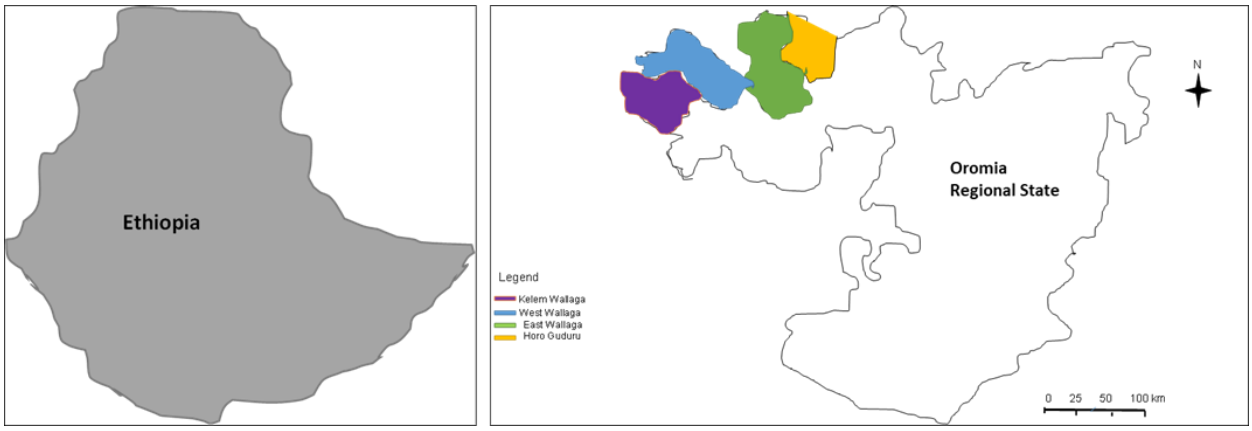

Figure 1. *Map of the study area*

Research design

This study employed a quantitative research design to examine the factors influencing the adoption of biodiversity finance in Western Oromia, Ethiopia. The approach focused on systematically measuring stakeholder perceptions, institutional practices, and socio-environmental factors that drive or hinder the adoption of biodiversity finance. The structured questionnaire was developed based on theoretical constructs from interdisciplinary literature, ensuring alignment with international frameworks such as the Convention on Biological Diversity (CBD, 2020) and the UNDP Biodiversity Finance (UNDP, 2020).

Source and data collection

Primary data were collected via a structured questionnaire from key stakeholders, government officials, CBOs, and NGOs covering seven domains: financial, economic, social, environmental, conceptual, framework, and human capital. Secondary data were sourced from scholarly literature. A pilot test with local institutions refined the questionnaire, ensuring clarity, contextual relevance, and content validity.

Sampling technique

Purposive sampling was employed to select respondents with decision-making authority, relevant knowledge, or active involvement in biodiversity finance mechanisms. This

approach was adopted to ensure the richness and relevance of the data and to focus on stakeholders most likely to provide informed responses regarding biodiversity finance adoption. The purposive sampling technique is widely recognized in social and implementation research for targeting specific populations with relevant expertise (Etikan et al., 2016).

Sample size determination

The study sample consisted of 176 individuals across the four zones of Western Oromia, namely East Wallaga, Horro Guduru Wallaga, West Wallaga, and Kellem Wallaga. Specifically, 35 individuals were selected from each zone, along with five representatives from CBOs and four from NGOs in each zone. The respondents were primarily located in the zonal towns of Nekemte, Shambu, Gimbi, and Dambi Dollo. This sample size was determined to adequately represent key stakeholders involved in biodiversity finance while ensuring coverage of diverse institutional, social, and environmental perspectives.

Data analysis

Descriptive analysis

Data analysis was carried out using descriptive statistics, including mean, skewness, and kurtosis. and standard deviation. These metrics offered a summary of stakeholders' perceptions regarding biodiversity finance strategies. They also assisted in evaluating the significance that participants assigned to every element, thus laying a strong groundwork for further examination.

Correlational analysis

Pearson correlation coefficients were computed to assess the two-variable relationships between the independent and dependent variables, characterized by the implementation of biodiversity finance initiatives. The examination revealed factors that could potentially affect results by showing the direction and intensity of their connections. Prior to performing the regression analysis, the correlation matrix served as an initial assessment to check the multicollinearity.

Multiple linear regression model

Multiple linear regression analysis was conducted to identify the key barriers that affect the biodiversity finance adoption scheme. The seven dimensions include financial, economic, institutional, environmental, social, conceptual, and skilled personnel. The objective of the model was to evaluate the level and direction of influence of each variable.

The typical formula utilized for examining a multiple linear regression model that incorporates seven independent variables (X_1 to X_7) to forecast one dependent variable (Y) is presented below:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \epsilon$$

Where:

Y refers to the dependent variable (Biodiversity Finance Adoption)

β_0 indicates the y-intercept refers to the (Y) value when every independent variable is set to zero

$\beta_1 \ldots\ldots\ldots \beta_7$= The regression coefficients, also known as slopes, are associated with each independent variable. Each coefficient indicates the anticipated variation in (Y) resulting from a one-unit rise in its related (X) variable, assuming that all other (X) variables remain unchanged.

$X_1 - X_7$ = The seven independent variables (Table 1)

ϵ denotes the error term (or residuals), representing the unexplained variation in the model.

Model diagnostics and assumption test

The dependent variable was the adoption of biodiversity finance mechanisms, measured through stakeholder engagement in initiatives such as green bonds, environmental funds, social impact bonds, and related conservation finance practices. Seven independent dimensions were examined: financial, economic, skilled personnel, framework, social, conceptual, and environmental factors. These captured, respectively, funding access and budgeting efficiency; economic incentives and income conditions; technical expertise and professional capacity; policy clarity, governance, and regulatory support; community awareness and stakeholder participation; conceptual understanding of biodiversity finance and sustainability frameworks; and environmental conditions, biodiversity pressures, and land-use practices. All variables were measured using structured Likert-scale questionnaire items to facilitate quantitative analysis of their influence on adoption.

Response rate

A total of 97.8% of the 180 questionnaires that were sent to the selected participants were correctly completed and returned. There was a 2.8% non-response rate, since the remaining four surveys were not returned. This degree of response is believed acceptable for statistical analysis and for precise comprehension of the study's objectives.

Demographic characteristics of the respondents

The demographic profile of the respondents includes a broad range of ages, genders, educational backgrounds, organizational affiliations, and work experience in biodiversity-related fields. Men were more likely than women to be among the responders. The bulk of participants were in the 25–44 age range, indicating that they were professionals in their middle years. The sample was reasonably well-educated, as evidenced by the majority of respondents holding bachelor's degrees or higher. Most participants came from financial institutions and environmental protection organizations, while fewer were from NGOs, CBOs, and the private sector. Many respondents reported four to ten years of experience in the environment, biodiversity conservation, and sustainable finance (Table 1).

Table 1

Demographic characteristics of respondents (N=176) in the study area

Variable	Category	Frequency	Proportion (%)
Gender	Male	107	60.97
	Female	69	39.03
Age Group	<25 years	22	12.2
	25-34 years	60	34.15
	35-44 years	68	38.89
	45-54 Years	18	10.22
	≥50 Years	8	4.54
Educational Level	Primary	18	10

Table 1 continues.

	Secondary	21	12
	Diploma	19	11
	Bachelor'	79	45
	Masters	35	20
	Doctorate	4	2
Organization	Environmental Protection Agency	69	39
	Local NGO	21	12
	Community-Based Organization (CBO)	14	8
	Financial institution	63	36
	Private sector (green investment)	9	5
Years of experience in the areas of biodiversity conservation, environment and sustainable finance.	<1 year	9	5
	1-3 years	32	18
	4-6 years	67	38
	7-10 years	49	28
	> 10 years	19	11

Descriptive analysis of biodiversity finance adoption impediments

As shown in Table 2, the descriptive statistics highlight key patterns and variations influencing the utilization of biodiversity finance mechanisms in Western Oromia, Ethiopia. The analysis examined seven groups of independent variables: financial, economic, skilled workforce, framework-related, social, conceptual, and environmental factors, alongside a dependent variable reflecting the current status of biodiversity finance implementation.

Financial constraints emerged as a major challenge, with an overall mean score of 3.96 (SD = 0.38). Respondents strongly agreed on the absence of effective green and biodiversity finance mechanisms (M = 3.79), while views on institutional budget allocations for biodiversity were more divided (M = 3.09; SD = 1.12), indicating uneven funding perceptions across institutions.

Economic factors were also rated highly (M = 3.91; SD = 0.20), reflecting widespread concern over limited financial support for conservation. In particular, insufficient funding from conservation-oriented financial sources received the highest rating (M = 4.24; SD = 0.58), underscoring systemic weaknesses in economic incentives for biodiversity finance.

Human resource constraints were perceived as moderately important (M = 3.54; SD = 0.50). Limited understanding of biodiversity finance was considered a more serious issue (M = 3.68) than its exclusion from educational curricula (M = 3.12), revealing gaps in professional capacity development and training.

Social factors recorded a moderate mean score of 3.59 (SD = 0.10). Weak implementation of corporate social responsibility was identified as the most critical social challenge (M = 3.85), while issues related to social justice, peace, and conflicting investment interests, though slightly lower, remained notable barriers.

Conceptual and environmental concerns were rated most critically, with several indicators exceeding a mean score of 4.0. Excessive consumption of natural resources ranked highest (M = 4.31), followed by environmental degradation and challenges in achieving the SDGs (both M = 4.27).

Environmental factors overall received a high mean score (M = 3.95; SD = 0.36). Key concerns included heavy chemical use in agriculture (M = 3.83) and limited expert performance (M = 3.78). Although the lack of sustainable farming practices received a lower score (M = 3.13), it still reflects substantial challenges in promoting biodiversity-friendly land use.

Table 2

Descriptive statistics on the determinants of biodiversity finance scheme adoption in Western Oromia, Ethiopia (N = 176)

Variable Category	Variable Name	Description	Descriptive Statistics			
			Minimum	Maximum	Mean	Std. D
Financial Factors	Lack of green and biodiversity finance mechanisms	Limited access to biodiversity-specific financial instruments, such as green bonds or PES.	3	5	3.79	0.775
	Sustainable financing availability	Availability of long-term financing aligned with biodiversity conservation.	2	5	3.63	0.761
	Environmental financing	Availability of funding targeted toward environmental sustainability.	3	5	3.20	0.895
	Lack of subsidies and viable alternatives	Absence of financial incentives or substitution schemes for unsustainable practices.	2	5	3.58	0.774
	Inadequate biodiversity budget allocations	Government or institutional underfunding for biodiversity projects.	1	5	3.09	1.121
	Financial factors	Cumulative values.	2	4	3.96	0.378
Economic Factors	Unemployment	High unemployment levels are a barrier to conservation investment.	1	4	3.58	0.803
	Personal interests of sectoral actors	Conflicting individual or institutional interests are hindering joint action.	2	5	3.59	0.703
	Low financial gains	Limited profitability from biodiversity conservation ventures.	2	5	4.03	0.684
	Low interest rates	Interest rates discourage investment in biodiversity projects.	2	5	3.79	0.839
	Opportunity costs	Losses incurred by choosing conservation over more profitable land use.	2	5	3.65	0.725
	Debt burden	High levels of debt servicing reduce funds available for conservation.	2	5	3.78	0.692
	Inflationary pressures	Inflation reduces the real value of conservation investments.	3	5	3.77	0.609
	Resource scarcity	Lack of essential resources for financing biodiversity initiatives.	2	5	3.85	0.734

Table 2 continues.

	Individual emigration	Skilled individuals are leaving rural areas, reducing project capacity.	1	5	4.01	1.045
	Overpopulation	Pressure on land and resources due to population growth.	2	5	4.05	0.94
	Lack of conservation funding facilities	Absence of banks or credit institutions supporting conservation.	2	5	4.24	0.576
	Cumulative values		3.4	4.4	3.913	0.198
Skilled Personnel	Inadequate technical expertise	Lack of skilled personnel and technological support for biodiversity finance.	1	5	3.5	1.009
	Limited guidance from trained professionals	Inadequate professional leadership for sustainability initiatives.	1	5	3.54	1.047
	Low familiarity with biodiversity finance	Practitioners are unaware of the tools and mechanisms of biodiversity finance.	1	5	3.68	0.909
	Conceptual ambiguity distracts investors.	Confusion about biodiversity finance deters investment.	1	5	3.36	1.071
	Lack of biodiversity finance in the curriculum	Absence of formal education or academic programs on biodiversity finance.	1	5	3.12	1.097
	Skilled Personnel	Cumulative values.	2.181	4.636	3.535	0.497
Framework-related Issues	Lack of framework	Absence of formal institutional frameworks for biodiversity finance.	1	5	4.23	0.691
	Political instability	Uncertainty deters long-term conservation investments.	1	5	4.4	0.771
	Lack of supportive policies	No enabling policy environment for conservation finance.	1	5	3.98	0.923
	Lack of risk management	No safeguards or insurance mechanisms for biodiversity finance investments.	1	5	3.62	0.978
	Weak enforcement of environmental laws	Poor compliance and legal accountability.	1	5	3.6	1.261
	Absence of awareness campaigns or motivation	Limited public engagement or behavioral nudges.	1	5	3.66	1.089
	Poor fund allocation and lack of incentives	Mismanagement of conservation budgets and the absence of reward systems.	1	5	3.52	0.907

Table 2 continues.

	Need for systemic governance and fiscal reforms	Absence of integrated reforms (tax, cities, joint ventures, etc.).	1	5	3.83	1
	Framework-related Issues	Cumulative values.	3.555	4	3.863	0.141
Social Factors	Lack of Corporate Social Responsibility (CSR)	The private sector is not investing in biodiversity-related CSR initiatives.	2	5	3.85	0.556
	Weak socially responsible investments	Low levels of ethical investment in conservation	2	5	3.71	0.536
	Social psychology	Attitudes, beliefs, and trust regarding biodiversity finance.	3	5	3.64	0.504
	Lack of social justice and peace	Social conflict undermines collective biodiversity action.	2	4	3.51	0.545
	Conflicts of interest in social investment	Competing goals between social investors and conservation needs.	2	5	3.53	0.575
	Social Factors	Cumulative values.	3.143	3.857	3.589	0.104
Conceptual Factors	Harmful production systems	Industrial practices are causing environmental degradation.	2	5	4.05	0.703
	Overuse of natural resources	Excessive exploitation of biodiversity assets.	4	5	4.31	0.462
	Lack of awareness and advisory services	Limited public understanding and professional advice.	3	5	4.06	0.648
	Inadequate recycling systems	Poor waste management is contributing to ecosystem stress.	2	5	3.89	0.845
	Environmental degradation (pollution, deforestation, etc.)	Broad environmental threats impede biodiversity conservation.	3	5	4.27	0.56
	Need for biodiversity conservation	Recognition of biodiversity's ecological and social value.	3	5	4.24	0.504
	Barriers to SDG adoption	Hindrances in aligning biodiversity finance with SDG goals.	2	5	4.27	0.537
	Importance of biodiversity finance	Perception of biodiversity finance's relevance to sustainability.	2	5	4.11	0.838
	Conceptual Factors	Cumulative values.				
Environmental Factors	Inadequate agricultural funding	Poor investment in environmentally friendly agriculture.	1	5	3.56	1.046

Table 2 continues.

	Unavailability of eco-friendly inputs	Lack of fertilizers, seeds, and inputs supporting sustainability.	1	5	3.96	0.897
	Unstable agricultural markets	Volatility in prices discourages conservation-oriented production.	2	5	3.42	0.803
	Lack of modern machinery	Obsolete farming practices harming ecosystems.	1	5	3.7	0.737
	Absence of land/rent and restoration policies	Gaps in land-use regulation hinder conservation.	1	5	3.66	0.887
	Low export performance	Inability to access green markets.	1	5	3.78	0.902
	Overuse of chemicals in farming	Unsustainable agricultural practices are degrading biodiversity.	2	5	3.83	0.878
	Exit of organic fertilizers	A shift away from organic farming reduces environmental sustainability.	1	6	3.59	1.192
	Lack of sustainable farming practices	Traditional agriculture undermines biodiversity goals.	1	5	3.13	0.962
	Environmental Factors	Cumulative values.	2.67	4.44	3.95	0.359
Dependent Variable	Government biodiversity spending	Funds allocated to biodiversity by public institutions.	3	5	3.88	0.874
	Measurable conservation impacts	Biodiversity finance outcomes in terms of ecosystem recovery and species protection.	2	5	3.68	0.722
	Identification of harmful financial flows	Ability to detect and address financial streams damaging biodiversity.	4	5	4.05	0.783
	Adherence to green finance principles	Application of green bonds, loans, and private equity in practice.	3	5	3.32	0.877
	Biodiversity finance	Cumulative values	2.166	3.166	3.775	0.186

Correlational analysis of biodiversity financial adoption schemes

A bivariate Pearson correlation analysis was conducted to examine factors influencing the uptake of biodiversity finance mechanisms (Table 3). The results show that accessible and simple financial mechanisms strongly encourage adoption, with financial factors exhibiting a robust positive association with biodiversity finance ($r = 0.624$, $p < 0.01$). Significant positive correlations were also observed with environmental factors ($r = 0.478$), regulatory frameworks ($r = 0.282$), a skilled workforce ($r = 0.305$), and social influences ($r = 0.260$), all at $p < 0.01$. These findings indicate that institutional arrangements, favorable economic conditions, and human capacity jointly shape effective biodiversity financing. Economic factors were positively related to both financial and environmental conditions. suggesting mutually reinforcing effects. However, a weak negative correlation between a skilled workforce and economic factors ($r = -0.151$, $p < 0.05$) points to limited coordination between capacity-building efforts and economic policy. Overall, the results highlight the need for integrated financial, institutional, and human-capital strategies to enhance biodiversity finance.

Table 3

Pearson correlation matrix among study variables (p < .05, p < .01)

Variables	1	2	3	4	5	6	7	8
1. Biodiversity Finance	1	.282**	.284**	.624**	.478**	.305**	.260**	0.066
2. Framework Factors		1	−.165*	.161*	0.132	0.062	−.037	−.097
3. Economic Factors			1	.209**	.367**	−.151*	−.014	−.044
4. Financial Factors				1	.174*	0.086	0.029	−.076
5. Environmental Factors					1	−.005	0.097	−.028
6. Skilled Personnel						1	0.106	0.087
7. Social Factors							1	0.055
8. Conceptual Factors								1

Source: Authors' Compilation

Reliability and validity test

To ensure model reliability and validity, residual normality was assessed using Q–Q plots and the Shapiro–Wilk test, while multicollinearity was examined using the Variance Inflation Factor (VIF) and tolerance statistics for seven predictor variables (social, framework, conceptual, skilled personnel, environmental, financial, and economic factors). Although measured using Likert-scale items, these variables were treated as continuous composite scores, a widely accepted practice in social science regression analysis (Hair et al., 2010).

Table 4

Statistics on collinearity for the independent variables that are part of the model.

Factors	Tolerance	VIF
Social	0.874	1.1444
Framework	0.67	1.493
Conceptual	0.77	1.298
Skilled personnel	0.81	1.234
Environmental	0.878	1.138
Financial	0.97	1.029
Economic	0.93	1.069

All VIF values were below 5.0 (1.029–1.493) and tolerance values exceeded 0.1 (0.67–0.97) (Table 4), indicating no multicollinearity concerns. Analyses were conducted in SPSS version 27 at a 95% confidence level ($p < 0.05$), using standardized beta coefficients to compare predictor effects.

Model summary

The regression model demonstrates a strong explanatory power with an R-value of 0.824 and an R^2 of 0.679. This means that approximately 67.9% of the variation in the adoption of biodiversity finance can be attributed to the combined influence of social, economic, financial, environmental, framework, conceptual, and skilled personnel factors (Table 5). The adjusted R^2 value of 0.663 further confirms the model's robustness, even after accounting for the number of predictors. The standard error of the estimate, which is 2.976, indicates a reasonably good fit for the model. The significance of the selected predictors is supported by the statistical change in R^2, with an F-value of 44.114 ($p < 0.001$) for the seven predictors against 167 observations.

Table 5

Summary of regression model predicting biodiversity finance in Western Oromia, Ethiopia

Model Summary [b]	
R	.824[a]
R^2	0.679
Adjusted R^2	0.663
Std. Error	2.976
Change R^2 Statistics	
R Change	0.679
F Change	44.114
df1	7
df2	167
Sig. F Change	0.000
Durbin-Watson	2.064

a. Predictors: (Constant), Social, Economic, Financial, Environmental, Framework, Conceptual, and Skilled Personnel factors. b. Dependent Variable: Biodiversity Finance

Analysis of variance: Significance of the regression model

A significant portion of the variance in the adoption of biodiversity finance mechanisms can be explained by the independent variables analyzed together, as indicated by a statistically significant overall model (Table 6). The regression model achieved an F-value of 44.114 ($F(7, 167) = 44.114$, $p < .001$), according to the ANOVA results (Table 6). This indicates that the model significantly predicts the dependent variable, biodiversity finance. The total sum of squares was 4605.727, of which 3126.332 was attributed to the regression and 1479.395 to the residuals (Table 7). This suggests that seven predictors influence a considerable amount of variability in the adoption of biodiversity finance: social factors, economic factors, financial factors, environmental factors, framework factors, conceptual factors, and skilled personnel. The high F-value and low significance level indicate strong overall results.

Table 6

Analysis of variance (ANOVA) results for the multiple regression model assessing predictors of biodiversity finance adoption.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3126.332	007	390.782	44.114	.000[b]
	Residual	1479.395	169	8.847		
	Total	4605.727	176			

a. Dependent Variable: Biodiversity Finance

Econometric model

As shown in Table 7, financial factors exert the strongest influence on biodiversity finance adoption (β = 16.761, p < 0.001), highlighting the central role of funding availability, financial incentives, and risk-sharing mechanisms. Framework factors also show a substantial effect (β = 9.268, p < 0.001), underscoring the importance of enabling legal, policy, and institutional arrangements. Social factors also contribute significantly (β = 7.098, p < 0.001), indicating that social awareness, trust, and stakeholder participation are critical facilitators. Skilled personnel have a positive and significant effect (β = 4.265, p = 0.002), reflecting the value of trained professionals in conservation finance. Economic (β = 3.061, p < 0.001) and environmental factors (β = 3.658, p < 0.001) further support adoption by shaping investment conditions and conservation motivations. Conceptual factors show a smaller but significant role (β = 1.389, p = 0.022). Overall, biodiversity finance adoption emerges from the combined influence of financial, institutional, human, social, and environmental drivers.

Table 7

Multiple linear regression analysis.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-154.239	13.808		-11.17	0
	Social Factors	7.098	1.709	0.195	4.152	0
	Skilled Personnel	4.265	1.384	0.165	3.081	0.002
	Financial Factors	16.761	1.764	0.475	9.502	0
	Economic Factors	3.061	0.502	0.297	6.098	0
	Environmental Factors	3.658	0.668	0.256	5.474	0
	Conceptual Factors	1.389	0.602	0.103	2.307	0.022
	Framework Factors	9.268	2.255	0.186	4.11	0

Discussion

Financial factors influencing biodiversity finance adoption

This study identifies financial factors as the primary barrier to the adoption of biodiversity finance mechanisms in Western Oromia, Ethiopia, highlighting the critical role of funding availability, incentives, and risk-sharing arrangements. This finding is consistent with sustainable finance theory, which emphasizes that adequate financial infrastructure is essential for mobilizing

environmental investment and aligns with evidence from biodiversity offsets, green bonds, and conservation trust funds (OECD, 2020).

The results suggest that improving adoption of biodiversity finance requires addressing structural financial constraints rather than isolated project-level gaps. Key challenges include the absence of dedicated biodiversity finance instruments such as green credit facilities, conservation trust funds, green bonds, and payment for ecosystem services, forcing reliance on short-term donor funding with limited integration into domestic financial systems (Kassahun et al., 2020). In addition, biodiversity investments typically require long time horizons, yet funding in Ethiopia is often short-term, leading to declining conservation outcomes once external support ends (Alemu et al., 2022).

Public financing for biodiversity also remains low and inconsistent, reflecting competition with other development priorities and a persistent gap between policy commitments and budget allocations (FDRE, 2022). Finally, weak financial incentives and limited risk-sharing mechanisms discourage participation by local communities and private actors, reducing conservation uptake when opportunity costs are not adequately compensated. Overall, sustained, predictable funding and targeted financial incentives are essential for mainstreaming biodiversity finance and achieving lasting conservation outcomes.

Economic barriers and market failures

Economic constraints and market failures remain major impediments to biodiversity finance. Respondents perceived conservation investments as high risk with low financial returns, and economic factors emerged as a key barrier (M = 3.91). This aligns with neoclassical economic theory, which posits that unfavorable economic conditions increase uncertainty and transaction costs, discouraging long-term environmental investment (Arrow et al., 2014). In Ethiopia, conservation is often viewed as yielding limited direct economic benefits (Alemu et al., 2022), reflecting a broader global challenge in which ecosystem services are systematically undervalued or excluded from markets (Dasgupta, 2021).

Macroeconomic volatility further reduces investor confidence, as inflation, currency depreciation, and limited access to private capital heighten perceived risk and constrain sustainable investment (Stock Market, 2025). Although green and biodiversity-oriented financial instruments are increasingly recognized, low awareness and limited availability continue to hinder their uptake. These challenges are particularly acute in fragile economies, where resource constraints and low returns restrict investment flows (OECD, 2024).

Addressing these barriers requires stable macroeconomic conditions, supportive regulatory frameworks, and active engagement by government and the financial sector. Initiatives such as Ethiopia's Greening Financial Systems Programme demonstrate the potential of policy reform to unlock sustainable and biodiversity finance, in line with SDG objectives (World Bank, 2024).

Environmental factors affecting biodiversity finance initiatives

Environmental pressures directly degrade land productivity, undermine ecosystem functions, and constrain economic development. In the agricultural sector, inadequate allocation of financial and technical resources has emerged as a critical challenge. As a result, farmers and practitioners are often pushed toward short-term, environmentally harmful practices, which further accelerate land degradation and biodiversity loss. Declining agricultural yields, in turn, weaken national economies such as Ethiopia's by reducing farm productivity and export potential.

The findings of this study (M = 3.95) indicate that environmental challenges, particularly unsustainable farming practices and excessive chemical use, are key drivers of biodiversity loss, while simultaneously highlighting the need for increased biodiversity-oriented finance. This outcome is consistent with ecological economics theory, which stresses that environmental degradation and ecosystem service scarcity can stimulate conservation investment when properly

valued (Costanza et al., 2014). Similarly, IPBES (2019) identifies land-use change and agricultural intensification as major global drivers of biodiversity decline, reinforcing the urgency of environmentally informed financing mechanisms.

Institutional frameworks and governance gaps

Weak governance and fragmented institutional frameworks remain major barriers to effective biodiversity finance. Achieving the SDGs requires active government leadership and coordinated action across all levels, as emphasized by most survey respondents. Institutional factors scored a relatively high mean (3.86), reflecting serious governance challenges. Political instability (mean = 4.40) and the absence of clear policy frameworks (mean = 4.23) were the most critical constraints. The strong effect of the framework factor (β = 9.268) highlights the importance of robust legal, policy, and institutional arrangements in mobilizing biodiversity finance. Findings from Ethiopia (EEFRI, 2020) indicate fragmented regulatory systems, and at the global level, weak governance, limited transparency, and low public awareness continue to hinder investment in biodiversity (OECD, 2020). Strengthening legislation, enforcement, and environmental education is therefore crucial to promote sustainable practices and mobilize biodiversity finance.

Human capacity deficits and the role of skilled personnel

Limited technical expertise emerged as a key constraint, with skilled personnel scoring a mean of 3.54 (β = 4.265). The presence of trained professionals such as conservation economists, financial analysts, project managers, and environmental specialists significantly improves the design, management, and implementation of biodiversity finance instruments. Globally, technical expertise is critical for conservation finance, payments for ecosystem services, and climate finance projects (OECD, 2020). In Ethiopia, low familiarity with biodiversity finance tools (mean = 3.68) reflects this capacity gap, supported by regression (β = 0.165, p = 0.002) and correlation results (r = 0.305, p < 0.01). Successful projects worldwide consistently integrate strong capacity-building programs.

Social dimensions and community engagement

Cultural and institutional barriers continue to constrain the inclusiveness of biodiversity finance initiatives. In this study, social factors scored moderately (M = 3.59), highlighting persistent issues with social justice, limited stakeholder participation, and weak corporate social responsibility (Tesema et al., 2021). Empirical evidence shows that strong community engagement and social cohesion enhance participation in conservation finance (Tesfaye et al., 2021). Our analysis confirms this, with a significant regression coefficient (β = 0.195, p < 0.001) and positive correlation (r = 0.260, p < 0.01), indicating that trust, social networks, and stakeholder awareness are critical for effective biodiversity finance. In Ethiopia, participatory governance, such as community-managed forests, has improved conservation outcomes (Girma & Beyene, 2020), consistent with global findings that local leadership strengthens commitment and sustainability.

Conceptual understanding plays a supportive but secondary role (β = 0.103, p = 0.022), emphasizing that awareness alone is insufficient without enabling institutional, financial, and educational frameworks.

Inter-factor relationships and structural misalignments

The negative correlation between economic factors and skilled personnel (r = −0.151, p < 0.05) may indicate an imbalance in policy focus, where economic development is not matched by a proportional investment in human resources. Additionally, the negative correlation between institutional frameworks and economic factors (r = -0.165, p < 0.05) suggests a misalignment between macroeconomic objectives and biodiversity conservation policies. These findings align with reports from low-income countries, where conservation efforts often conflict with the need for short-term economic growth that emphasizes the

need to balance biodiversity goals with economic growth through integrated planning and coherent policy (IPBES, 2019).

Ethiopian biodiversity finance policies, regulatory frameworks, and funding landscape

Ethiopia's efforts on biodiversity finance rest on a web of laws, proclamations, and institutional rules, all aimed at conserving and using biological resources sustainably. The country has made real headway, especially with the Biodiversity Conservation and Research Institute and the Environmental Policy of Ethiopia, 1997. Key laws such as the Forest Development, Conservation, and Utilization Proclamation No. 542/2007 and the Environmental Impact Assessment Proclamation No. 299/2002 lay the groundwork for bringing biodiversity into national development planning and keeping resource management sustainable (EEFRI, 2020).

Ethiopia faces major hurdles in putting these policies into practice. The problems come down to a lack of fiscal decentralization, unclear or overlapping mandates, and weak enforcement (Tesfaye et al., 2021). Fragmented policy coordination makes it even harder to mobilize and distribute biodiversity finance effectively, as this study also found when looking at governance and institutional gaps (M = 3.86). On top of that, budget planning for biodiversity continues to fall short.

Ethiopia has tapped into global finance mechanisms such as the Global Environment Facility (GEF), the Green Climate Fund (GCF), and various sources of bilateral aid for climate adaptation and ecosystem restoration (UNDP, 2025). However, the effectiveness requires maximum effort.

CONCLUSIONS

The current research investigates the challenges associated with implementing biodiversity finance in Western Oromia of Ethiopia. An extensive review of existing literature was performed to identify these challenges, which informed the development of an interview protocol designed to engage members from various NGOs, agencies, and financial organizations, experts in the field; policymakers; and active investors. This data facilitated the evaluation of different inquiries to visually depict the results and outline the obstacles to adopting biodiversity finance initiatives. The results uncovered several issues related to conceptual, social, environmental, financial, economic, structural, and territorial aspects, as well as future outlooks of the concept. Notably, financial and economic challenges were identified as critical issues, with economic constraints having the highest standardized beta value ($\beta = 0.475$, $p < 0.001$). This underscores the necessity for dependable and stable funding sources. Economic disincentives reveal that market failures and the underappreciation of ecosystem services impede acceptance, highlighted by poor returns on conservation investment and elevated opportunity costs, exacerbating the situation. Biodiversity finance mainly focuses on areas facing ecological decline, highlighting the urgent need for environmental investments. Issues like political unrest and weak governance hamper progress. A lack of skilled professionals limits local capacity. Although social factors are important for community engagement, they are less influential. Effective biodiversity finance is key to achieving sustainability.

Recommendations

Drawing on the study's findings, this research recommends that policymakers integrate biodiversity finance into national financial and environmental frameworks through clear regulations, incentives, and risk-mitigation mechanisms. Given the strong influence of financial and economic factors, financial institutions should develop accessible biodiversity-oriented financial products and strengthen internal capacity through targeted training and investor awareness programs. Enhanced collaboration among government agencies, financial institutions, and conservation organizations is also essential to ensure ethical, inclusive, and effective biodiversity finance implementation. In particular, targeted financial incentives should support smallholder farmers in adopting biodiversity-friendly practices

that improve productivity, resilience, and market access. Future research should use mixed-methods and qualitative approaches across Ethiopia's key ecological regions, exploring governance, economics, and instruments like green bonds to enhance biodiversity finance understanding.

CRediT Authorship Contribution Statement

Keno Telila: Data Collection, Conceptualization, Analysis, and Writing Original Draft. **Habte Telila:** Supervision, Data Analysis & Model Validation, Review & Editing.

Declaration of Competing Interest

The authors declare that there is no conflict of interest.

Ethical approval

All procedures involving human participants were conducted in accordance with the ethical standards of the Wollega University Research Ethics Committee and with the 2013 Declaration of Helsinki and relevant national guidelines. Informed consent was obtained from all individual participants involved in the study after explaining the purpose, procedures, and their right to withdraw at any time. No participants under the age of 16 were included in the study.

Data Availability

The data generated and interpreted during this research is accessible from the authors upon a convincing request.

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