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Biodiversity Conservation And Its Role In Maintaining Ecosystem Services: Implications For Human Well-Being

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Abstract
Biodiversity underpins ecosystem resilience and the constant provision of facilities vital to maintaining human well-being. It examines the interface between biodiversity conservation, ecosystem service provision, and human well-being based on integrating field-based biodiversity measurement, ecosystem service valuation, and socio-economic analysis in six varied ecosystems, for instance, primary forests, secondary forests, wetlands, agroforestry, and cultivated lands. The findings show that ecosystems rich in biodiversity supplied significantly more provisioning, regulating, supporting, and cultural services compared to degraded ecosystems. Species-rich ecosystems offered more access to primary resources like fuelwood, medicinal plants, water, and wild edible species and supported significant ecological processes like carbon sequestration, soil quality, and pollination. Socio-economic impacts reflected a reliance of societies on biodiversity-related resources for livelihood, food security, and identity, with the majority of families being willing to pay for conservation since there is increased appreciation of the significance of biodiversity. Statistical analysis revealed a strong positive correlation of biodiversity, availability of ecosystem services, and human well-being, reaffirming that, in fact biodiversity is a major driver of sustainable development. The research finds that there is a critical need for cross-scale, community-led conservation efforts that strike a balance between ecological interest and human development imperatives. Conservation of biodiversity is essential to preserve ecosystem resilience, safeguard natural resources, and ensure long-term socio-economic and environmental sustainability.
Keywords: *Biodiversity conservation, Ecosystem services, Human well-being, Sustainable development, Environmental sustainability*

1. INTRODUCTION

Biodiversity, encompassing the variety and variability of all living beings and their ecological complexes, forms the foundation of life on our planet and is essential in safeguarding the stability and resilience of ecosystems. With complex ecological interactions, biodiversity facilitates the delivery of ecosystem services tangible and intangible products and services provided by nature supporting human existence, health, and socio-economic development (Haines-Young & Potschin, 2010). These functions encompass both direct contributions—such as the supply of food, water, energy, and medicinal resources—and indirect regulatory services, including carbon storage, pollination, climate moderation, and disease control, alongside cultural and recreational benefits that collectively influence human well-being at both individual and societal levels (Summers et al., 2012). The complex interdependence between human society and biodiversity highlights the reality that the degradation of natural systems presents severe consequences to ecological processes and human health. Despite such recognition, global biodiversity is facing an unprecedented crisis, with several reports having confirmed the decimating rates of species population decline, habitat integrity loss, and ecosystem function decline.

The magnitude and urgency of this crisis are highlighted by more recent data. According to the WWF Living Planet Report (2024), habitat loss, overuse, pollution, and climate change are the main causes of the roughly 69% average decline in wildlife populations worldwide since 1970. According to IPBES (2023), humans have significantly changed about 75% of terrestrial ecosystems and 66% of marine ecosystems, and nearly a mountain species are in danger of going extinct. The foundations of food security, freshwater provision, human health, and cultural identity are all threatened by these changes, which reduce ecosystems' capacity to deliver essential services

(Oguh et al., 2021). In addition, loss of biodiversity typically results in cascading ecological effects since species reduction lowers ecosystem stability, encroaches on the regulatory controls, and decreases the stability of natural processes under expanding anthropogenic pressures (Naeem et al., 2016

The multifaceted and context-dependent manner in which ecosystem services improve human well-being is one of its fundamental characteristics. The four categories of ecosystem services used by the MEA framework, provisioning, regulating, cultural, and supporting, all work together to exclusively support human existence (Summers et al., 2012). Necessities like food, clean water, and medication supplies are included in provisioning services, which have a direct impact on livelihood and financial stability. Long-term environmental stability, which is necessary for human survival, is provided by the regulation of services like disease, flood, and climate (Bennett et al., 2015). Cultural values, including spiritual, aesthetic, and recreational benefits, form collective identities and boost mental health, while enabling supports, including nutrient cycling, soil development, and habitat provision, allow ecosystems themselves to continue functioning (Hausmann et al., 2016). Nevertheless, these connections are not consistent and tend to exhibit elasticity, such that biodiversity's influence on ecosystem services and human well-being differs geographically, ecologically, and socially (Daw et al., 2016). In certain areas, especially those with rural populations whose livelihood depends on natural resources, loss of biodiversity can have direct and serious socioeconomic impacts, whereas in other environments, such effects might be cumulative but equally profound in the long run.

Emerging evidence also reveals strong links between biodiversity conservation and global health outcomes. The loss of biodiversity increases human vulnerability to infectious diseases, particularly zoonotic outbreaks, by altering species interactions and reducing natural regulatory mechanisms within ecosystems. Similarly, pollinator decline, resulting from habitat loss and pesticide exposure, threatens global food security by jeopardizing the production of nearly 75% of major food crops (IPBES, 2023). At the same time, cultural and psychological well-being are closely tied to connections with natural environments, as biodiversity-rich landscapes contribute to emotional stability, social identity, and cognitive restoration (Hausmann et al., 2016). Consequently, biodiversity conservation extends beyond ecological imperatives, encompassing dimensions of human health, nutrition, social resilience, and cultural sustainability that are increasingly recognized as critical for global development.

Bennett et al. (2015) identify three central research challenges: integrating ecological and social dimensions to better model human–nature interactions, talking trade-offs between conservation priorities and economic development, and designing effective, inclusive management strategies that incorporate local knowledge and community participation. Additionally, Alonso and Gutiérrez (2017) emphasize that public awareness and environmental literacy regarding ecosystem processes remain insufficient, with a limited understanding of how biodiversity sustains human life. While bibliometric analyses demonstrate a sharp increase in studies on ecosystem services and well-being over the past two decades, research remains fragmented across disciplines, limiting its application in policy and practical conservation strategies (Wang, Zhang, & Cui, 2021). Consequently, there is a pressing need for comprehensive frameworks that integrate ecological, social, economic, and cultural dimensions into biodiversity research and decision-making.

The increased congruence of scientific inquiry with global sustainability agendas indicates the need to tackle biodiversity decline. In the Sustainable development process is a core concern as per the frameworks of the Sustainable Development Goals (SDGs 13, 14 and 15) and the Convention on Biological Diversity (CBD). The disconnect between evidence and effective policy implementation, however, remains, with many conservation programs failing to incorporate interdisciplinary knowledge in full or capture some of the regional diversity in human–ecosystem relationships (Oguh et al., 2021). Closing this gap involves moving beyond traditional models of conservation towards inclusive schemes combining scientific understanding, local regulation, and participatory management practices.

Through integration of the accessible data and evaluation of the underlying drivers, consequences, and feasible counterstrategies to loss of biodiversity, the present research attempts to examine the interlinks between biodiversity conservation, ecosystem services, and human well-being. In addition, the lessons learned are meant to guide policy formulation and accommodate innovative strategies that enhance long-term ecological resilience and facilitate the sustained provision of key ecosystem services, culminating in wider objectives for global sustainability.

Research Objectives

1. To determine the role of biodiversity in maintaining ecosystem services essential for human well-being
2. To assess the impacts of biodiversity loss on ecosystem functionality and societal welfare

3. To explore effective conservation strategies and policy frameworks for sustaining biodiversity and ecosystem services

2. METHODOLOGY

2.1 Research Design

Quantitative field-based study design anchored on socio-economic assessments was used by the research to evaluate the role biodiversity conservation plays in the achievement of ecological services and its attendant implications to human well-being. The research involved the initial gathering of data on biodiversity and household surveys at the level of the community to establish an instant connection between ecological determinants and the requirement of society on ecosystem services. A comprehensive understanding of how biodiversity status contributes to the provisioning, regulation, support, and culturalization of ecosystem services and how these, in turn, impact local livelihoods and well-being was the outcome of this interdisciplinarity.

2.2 Study Area Selection

The investigation encompassed six ecologically significant locations, including forest fragments, agroforestry systems, and aquatic habitats, strategically chosen to capture the variability in habitat types and gradients of biodiversity richness. A stratified random sampling approach was employed to identify the study sites based on three primary criteria: ecological vulnerability, species diversity, and the extent of local community dependence on natural resources. During preliminary surveys, key environmental attributes such as vegetation composition, climatic conditions, and habitat characteristics were documented to establish baseline ecological profiles for each location. This systematic selection ensured that the chosen sites represented a wide spectrum of ecosystem conditions, thereby enabling robust comparative assessments of biodiversity patterns across different habitat types.

2.3 Data Collection Procedures

2.3.1 Biodiversity Assessment

Field-based surveys of biodiversity were done at all the sites selected to record species richness, abundance, and outlines of diversity. In vegetation, quadrat sampling was used through the use of 10 m × 10 m quadrats for trees, 5 m × 5 m for shrubs, and 1 m × 1 m for herbaceous plants. In each quadrat, information on species identity, individual count, DBH, and canopy cover was noted. For faunal diversity, line transects and point counts were employed for mammals and birds, respectively, and direct observation, signs, and calls for less cryptic species. Opportunistic sightings were overlaid on top of these censuses to collect maximum representation of uncommon and secretive species. Standard field guides and cross-checked with the IUCN Red List were used for validation of the species identification and their conservation status.

A number of different indices were employed to compute the indices that were employed to estimate biodiversity. Species diversity and richness were estimated by using the Shannon-Wiener Diversity Index (H'), whereas species dominance in the communities was estimated by using Simpson's Diversity Index (D). For estimating evenness of species distribution at each location, Pielou's Evenness Index (J) was also computed. These indices were employed to equate the biodiversity levels of various ecosystems and assess the effect on ecosystem services.

2.3.2 Ecosystem Services Assessment

The value of biodiversity contribution to ecosystem services was estimated using the MEA framework, wherein services are categorized into provisioning, regulating, supporting, and cultural types. For provisioning services, information was recorded on food, timber, fuelwood, medicinal plants, and freshwater directly obtained from surveyed ecosystems. The local consumption of these resources for livelihood and subsistence was recorded from community surveys. Pollination, microclimate regulation, and carbon sequestration services were measured based on vegetation parameters and species diversity data. Carbon storage was estimated using allometric equations that were extracted from DBH and height measurements in the vegetation survey. Supporting functions like soil fertility and nutrient cycling were quantified by collecting composite soil samples from quadrats to 0–30 cm and determining organic carbon, nitrogen, and phosphorus in the lab. For cultural services, community perceptions regarding spiritual, recreational, and aesthetic values were recorded to appreciate the social importance of biodiversity and ecosystem services.

2.3.3 Socio-Economic Surveys

Household surveys were conducted in villages located within or adjacent to the study sites to assess the human dependence on ecosystem services and perceptions toward biodiversity conservation. A total of 250 households were sampled, resolute using Cochran's formula at a 95% confidence level with a 5% margin of error. Structured questionnaires collected information on household demographics, income sources, utilization of ecosystem services, food security, and awareness of conservation issues. The CVM was used to estimate WTP for biodiversity

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conservation and ecosystem restoration. Semi-structured interviews with local leaders, forest officials, and environmental practitioners provided complementary insights into community governance structures, resource management practices, and challenges to biodiversity conservation.

2.4 Data Analysis

Data collected from biodiversity surveys, ecosystem service assessments, and socio-economic questionnaires were analyzed using both descriptive and inferential statistics. Ecological parameters were quantified using biodiversity indices, and site-level comparisons were performed to evaluate spatial variations. To evaluate the association between biodiversity levels and the availability of ecosystem services, Pearson's correlation was employed, while multiple regression analyses were conducted to determine how biodiversity richness influences various ecosystem service categories. It was examined through path analysis and Structural Equation Modeling (SEM) using AMOS v24, enabling the identification of both direct and indirect causal relationships. Socio-economic variables were processed using SPSS v26 to compute descriptive statistics, such as frequencies, percentages, and cross-tabulations. Additionally, relevant hypotheses were tested using independent t-tests and chi-square analyses, with all statistical interpretations considered significant at $p < 0.05$.

3. RESULTS

3.1 Species Richness, Composition, and Diversity

Across the six study sites, a total of 312 species were recorded, including 148 plant species, 102 faunal species, and 62 insect species, representing 124 genera and 81 families. Among these, 23 species were listed as endangered under the IUCN Red List, comprising six critically endangered and five endangered species. Species richness and diversity varied considerably across sites, with Site 1 (primary forest) exhibiting the highest richness (S = 112) and diversity (H' = 3.98), while Site 5 (cultivated landscape) recorded the lowest richness (S = 48) and diversity (H' = 2.65).

As presented in Table 1, the Shannon-Wiener Diversity Index (H') ranged from 2.65 to 3.98, while Simpson's Index (D) varied between 0.72 and 0.94 across sites. The Evenness Index (J) was highest in Site 1 (J = 0.89), suggesting an equitable distribution of species, whereas Site 5 (J = 0.61) showed lower evenness due to dominance by a few species. A one-way ANOVA indicated significant differences in species diversity between sites ($F = 19.63$, $p < 0.001$), demonstrating that land-use intensity and habitat disturbance are major determinants of biodiversity patterns.

Table 1. Species richness and diversity indices across study sites

Study Site	Total Species	Threatened Species	Shannon Index (H')	Simpson Index (D)	Evenness (J)
Primary Forest	112	6	3.98	0.94	0.89
Secondary Forest	98	5	3.62	0.91	0.85
Agroforestry Patch	85	4	3.25	0.86	0.80
Wetland Ecosystem	74	3	3.10	0.83	0.77
Cultivated Landscape	48	2	2.65	0.72	0.61
Freshwater Ecosystem	61	3	2.94	0.79	0.70

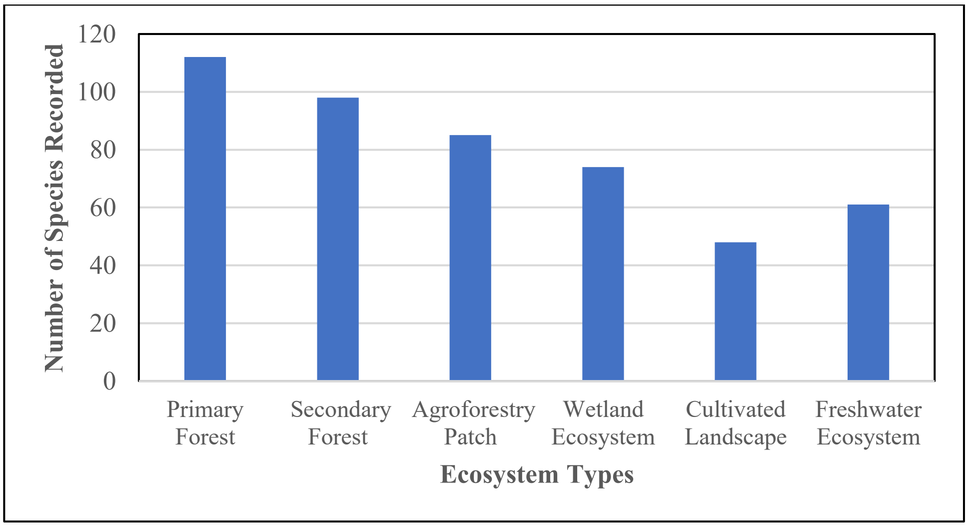

Figure 1: Species Richness Across Different Ecosystem Types

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Figure 1 illustrates species richness across six ecosystem types. Primary forests noted the highest number of species, followed by secondary forests, while cultivated landscapes exhibited the lowest richness, indicating significant biodiversity loss due to habitat disturbance and anthropogenic pressures.

3.2 Ecosystem Services Derived from Biodiversity

The assessment of biodiversity's contribution to ecosystem services demonstrated substantial variation across sites, with biodiversity-rich areas providing higher benefits under the MEA framework.

3.2.1 Provisioning Services

Provisioning services, including fuelwood, timber, medicinal plants, wild edibles, and freshwater resources, were closely linked to species richness. Table 2 shows that households in Site 1 had access to the highest average monthly fuelwood availability and medicinal plant species (22 species), whereas Site 5 recorded the lowest availability (14 kg of fuelwood and 7 medicinal plant species).

Freshwater access followed a similar trend, with Site 1 supporting 125 L/day per household, compared to 47 L/day in Site 5. Statistical analysis revealed a strong positive correlation between species richness and provisioning service availability. Regression analysis further indicated that biodiversity explained 72% of the variance in provisioning services, confirming that ecosystems with higher biodiversity deliver significantly greater material benefits to dependent communities.

Table 2. Provisioning services derived from different study sites

Provisioning Services	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Fuelwood (kg/household/month)	55	48	33	30	14	26
Medicinal plants (species used)	22	18	14	10	7	11
Freshwater availability (L/day)	125	108	86	92	47	105
Wild edible plants used	18	15	11	9	5	8

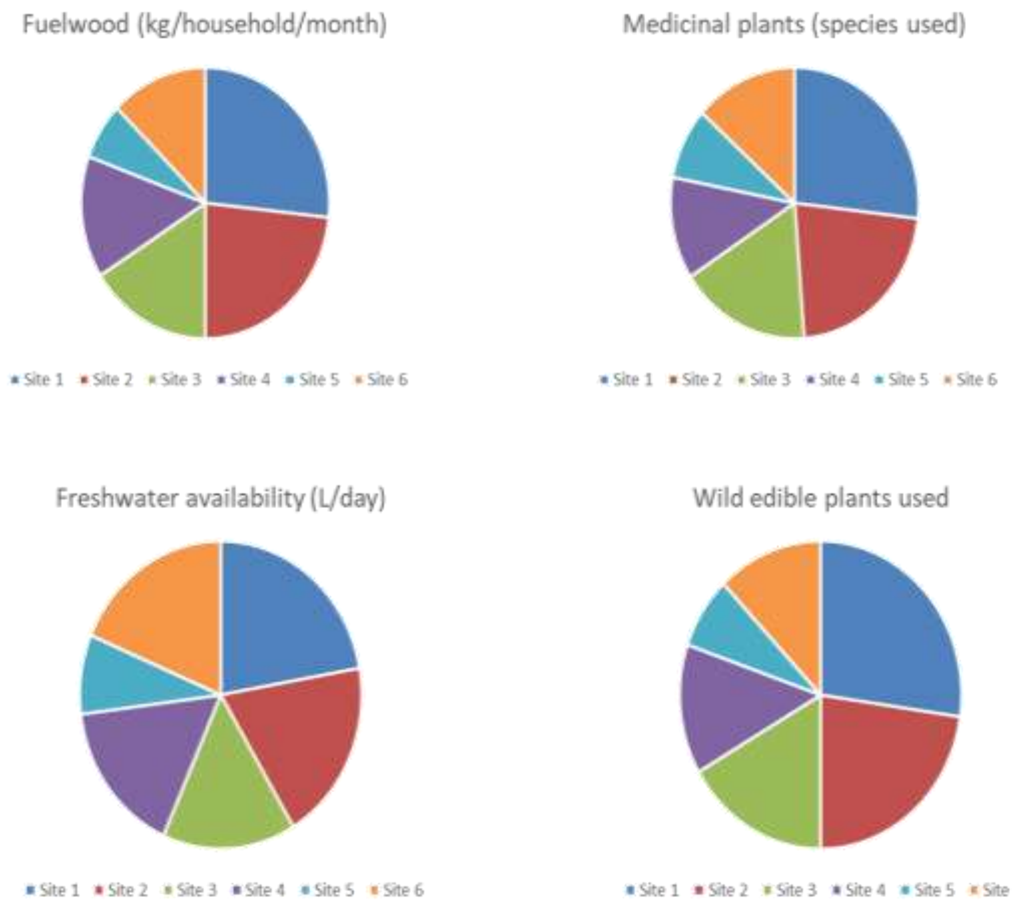

Figure 2: Pie charts showing Provisioning Ecosystem Services Across Different Study Sites

Figure 2 illustrates the variation in provisioning ecosystem services, including fuelwood, medicinal plants, freshwater availability, and wild edible plants, across six study sites. Sites 1 and 2 provide the highest resource availability, while Site 5 shows the lowest due to reduced biodiversity.

3.2.2 Regulating and Supporting Services
Regulating services, including pollination, carbon sequestration, and microclimate regulation, were highest in biodiversity-rich ecosystems. Pollinator abundance correlated positively with flowering plant diversity ($r = 0.79$, $p < 0.01$). Carbon sequestration potential, estimated from above-ground biomass, was highest in Site 1 (152.8 ± 5.6 Mg C ha^{-1}) and lowest in Site 5 (63.5 ± 4.2 Mg C ha^{-1}), highlighting the role of biodiversity in climate regulation. Secondary services, such as nutrient cycling, followed a similar trend. Laboratory soil analysis showed significantly higher organic carbon and nitrogen concentrations in Sites 1 and 2 than in degraded landscapes ($F = 16.22$, $p < 0.001$), indicating biodiversity's contribution to ecosystem sustainability.

3.2.3 Cultural Services
Survey responses revealed that 72% of participants considered biodiversity-rich ecosystems essential for spiritual, recreational, and aesthetic purposes, as illustrated in Table 2. Cultural attachment to natural landscapes was highest in Sites 1 and 2, where species diversity was greatest, while only 31% of respondents in Site 5 associated their local environment with cultural or spiritual value. This indicates that biodiversity conservation supports not only ecosystem functions but also socio-cultural well-being.

3.3 Socio-Economic Dependence on Biodiversity
Among the 250 surveyed households, a majority reported high reliance on biodiversity-derived ecosystem services. As shown in Table 2, 81% of households collected fuelwood, 69% used medicinal plants, and 74% relied on freshwater resources provided by biodiversity-rich ecosystems. Households located near Sites 1 and 2 reported higher livelihood security, while those near Sites 5 and 6 faced significant resource scarcity.

The CVM revealed that 58% of respondents expressed willingness to pay (WTP) for biodiversity conservation, with an average WTP of $2.65 per household per month. Regression analysis demonstrated that household income ($\beta = 0.46$, $p < 0.01$), education level ($\beta = 0.38$, $p < 0.05$), and ecosystem dependency ($\beta = 0.41$, $p < 0.05$) significantly predicted WTP, suggesting that socio-economic capacity strongly influences conservation behavior.

3.4 Relationship Between Biodiversity, Ecosystem Services, and Human Well-Being
The model demonstrated an excellent fit to the data ($\chi^2/df = 1.84$, RMSEA = 0.041, CFI = 0.96, TLI = 0.95), indicating a strong alignment between the observed data and the hypothesized relationships. Results exposed that biodiversity had a significant direct positive effect on the provisioning, regulating, and supporting ecosystem services ($\beta = 0.74$, $p < 0.001$). This suggests that greater delivery of ecosystem services like food, timber, pollination, and carbon storage was linked to locations with greater species richness and diversity. Consequently, ecosystem services directly improved human well-being ($\beta = 0.68$, $p < 0.001$), showing that increased access to ecosystem-derived resources enhanced local communities' cultural satisfaction, livelihood security, food availability, and health outcomes.

Furthermore, biodiversity also exerted a significant indirect influence on human well-being ($\beta = 0.63$, $p < 0.01$) through its effect on ecosystem services. In other words, biodiversity contributes to improved quality of life not only by maintaining the ecological balance but also by sustaining the flow of services that communities depend upon for their survival and socio-economic development As presented in Table 3, biodiversity had the greatest overall impact on ecosystem services, which in turn mediated a large proportion of its influence on human well-being. Together, the SEM outputs accounted for 71% of the variation in human well-being, affirming that biodiversity conservation is indispensable for augmenting socio-economic resilience, livelihood stability, and cultural enrichment.

DISCUSSION
Our results indicate that richer species sites, particularly primary and secondary forest, provided significantly higher provisioning, regulating, supporting, and cultural services than degraded or cropped plots. These results are consistent with global approximation, wherein the emphasis is laid on the aspect that biodiversity is the basis of ecological resilience and providing stable ecosystem service for supporting livelihoods, human well-being, and cultural identity (Zhang et al., 2019). In addition, the wide variation in species richness among the six ecosystems indicates the direct influence of land-use intensity, habitat disturbance, and utilization of resources on biodiversity loss. According to Oguh et al. (2021) and Liu et al. (2022), our evidence confirms that human-induced activities such as deforestation, agricultural expansion, and unsustainable harvesting of resources are still the leading contributors to environmental degradation, thus compromising the resilience of ecosystems to deliver essential services.

The fundamental role of biodiversity in maintaining ecosystem function is highlighted by the positive correlation found in this study between biodiversity and the facility of ecosystem services. The richest diversity of plant and animal species was found in primary and secondary forests, which consequently optimized provisioning services like food, fuelwood, freshwater, and medicinal products. Evidence supporting our results comes from Sharma and Birman (2024), which showed that species loss diminishes access to nutrition resources and medicinal plants, and in doing so creates long-term health and resilience risks within communities. Controlling and facilitating services like carbon sequestration, pollination, and nutrient cycling also rose proportionally with species richness. More biodiverse sites retained much more carbon and had improved soil fertility and pollinator richness, enhancing ecosystem resilience and climate change mitigation. These findings are supported by Daba and Dejene (2018), who demonstrated that diverse landscapes improve climate regulation through stabilizing atmospheric carbon, and Brauman (2015), who emphasized the important role played by diverse ecosystems in preserving hydrological balance and water security.

This study also demonstrates that biodiversity conservation provides important cultural and psychological benefits, which are often overlooked in ecosystem service assessments. Communities living near biodiversity-rich sites reported a stronger sense of identity, spiritual connection, and cultural attachment to their landscapes, while households in degraded ecosystems exhibited weaker cultural engagement. These findings resonate with Alfonso et al. (2017), who demonstrated that declines in ecosystem services directly reduce recreational opportunities, cultural traditions, and social cohesion. Beyond ecological and cultural benefits, the socio-economic results show that local livelihoods are highly dependent on biodiversity-derived resources. Over 80% of surveyed households reported using forests and wetlands for daily needs such as food, water, medicinal plants, and fuelwood. Similar trends were documented by Wang et al. (2017), who reported that biodiversity degradation disproportionately impacts resource-dependent rural populations, thereby increasing vulnerability to poverty and food insecurity.

The WTP results are encouraging proof of the increasing awareness of communities about the significance of biodiversity. Most households were willing to pay for conservation, which supports the reality that beneficiaries of ecology services are highly conscious of the contribution of biodiversity to their livelihood and well-being. These observations are consistent with Ali and Kamraju (2023), who highlighted that successful conservation is premised upon synthesizing community-based approaches, raising environmental awareness, and addressing socio-economic disparities, determining participation. Nevertheless, WTP variations across households, highlighting lingering disparities across income groups, education, and direct resource dependence, reflect the importance of such disparities in formulating inclusive and equitable biodiversity policies empowering marginalized groups while encouraging sustainable resource utilization.

Despite the intimate relationships between human health, ecosystem services, and biodiversity, the analysis still shows that there are systemic trade-offs between socio-economic expansion and ecological sustainability. Expansion of agriculture and infrastructure development are associated with reduced biodiversity and the provision of ecosystem services, particularly in cultivated land. This aligns with Watson et al.'s (2019) evidence that not integrating ecosystem thresholds into land-use planning weakens conservation effectiveness and erodes long-term human well-being. Besides, invasion of invaded ecosystems by alien species also steals species composition and ecological resilience since Vilà and Hulme (2017) considered biological invasions to decline ecosystem productivity as well as reduce provision of services. Climate change also imperils another threat in compelling biodiversity redistribution, range shifting, and affecting the resilience of ecosystems, as exposed by Pecl et al. (2017). Without any intervention, all these forces together pose the risk of undermining ecosystems' provision of ecological services as well as human needs.

In the policy agenda, such data highlights the necessity for an integrated, evidence-based conservation approach that combines ecological and socio-economic objectives. With the significant, beneficial contribution of biodiversity to ecosystem functioning and human well-being, there is an imperative to adopt community-based conservation models, ecosystem restoration programs, and sustainable use schemes. These strategies must be attached to international agendas such as the Sustainable Development Goals SDGs 13, 14, and 15, the CBD, and the Post-2020 Global Biodiversity Framework in order to have biodiversity conservation speak in terms of poverty reduction, climate resilience, and sustainable development. Avoiding homogenization of biodiversity through fair policy and ecosystem-based management is essential in the maintenance of ecological diversity and long-lasting sustainability, contributing to Newbold et al. (2019).

High biodiversity regions not only produce more material resources, i.e., food, water, and energy, but also provide greater regulating functions, cultural identity, and social harmony. In contrast, biodiversity loss contributes to ecosystem decline, resource depletion, and reduction in community welfare. These results are in agreement with global syntheses by Sharma and Birman (2024) and Liu et al. (2022), which together show that biodiversity is a pillar of sustainable development. However, achieving conservation goals requires balancing ecological priorities with economic demands through participatory governance and inclusive planning. Without immediate action, continued biodiversity decline will exacerbate environmental instability, deepen socio-economic inequalities, and undermine progress toward global sustainability targets.

4. CONCLUSION

The research proves that preserving biodiversity is vital to maintaining ecosystem services as well as enhancing human wellbeing since more species-rich ecosystems, especially primary and secondary forests, offered considerably higher provisioning, regulating, supporting, and cultural services than degraded landscapes. Places with high biodiversity guaranteed improved access to basic resources such as fuelwood, medicinal herbs, water, and wild foods, along with the preservation of important ecological services like carbon sequestration, soil quality, and pollination, thus ensuring environmental stability and livelihood resilience. In contrast, biodiversity loss in agricultural and perturbed ecosystems caused a loss in the provision of services, compromising the resilience of resource-based communities and enhancing socio-economic risks. The findings also bring to light the fact that biodiversity has a direct impact in auxiliary the supply of ecosystem services and indirectly enhances food security, cultural identity, and general living standards. The willingness-to-pay captures increased public concern for biodiversity's value and calls for inclusive and community-based conservation strategies that balance local engagement with fair policies. These revelations highlight the need to implement integrated biodiversity approaches that are complementary to global sustainability models in order to harmonize ecological needs with human development objectives. To sum up, preserving biodiversity is both ecologically essential and socio-economically necessary since it enhances ecosystem resilience, maintains key services, and guarantees human welfare, while doing nothing will speed up environmental degradation, worsen social inequities, and undermine the attainment of long-term sustainability objectives.

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