

The Mediating Effect of Environmental Attitudes in the Relationship between Biodiversity Conservation Programs and Mental Health:

Mostafa Kamal

Interanational Islamic University Chittagong

Mostafa.eb.iuc@gmail.com

Mohammed Baktiar

Presidency International School Chittagong

Abstract

This study investigates the potential mediating role of environmental attitudes in the relationship between biodiversity conservation programs and mental health. As global efforts to conserve biodiversity intensify, understanding the broader benefits of these programs, particularly their impact on human well-being, becomes crucial. Prior research has established a positive connection between nature exposure and mental health, yet the mechanisms underlying this relationship, including the role of environmental attitudes, remain less explored. This study employs a quantitative approach involving a cross-sectional survey to collect data from a diverse sample. Biodiversity conservation program participation, environmental attitudes, and mental health status are assessed using validated instruments. Correlation analysis reveals preliminary associations among the variables, and a mediation analysis is conducted to examine the extent to which environmental attitudes mediate the link between conservation programs and mental health. The findings aim to contribute to the theoretical understanding of the interplay between environmental attitudes, conservation efforts, and mental health, while also providing practical insights for the development of effective conservation programs that yield positive mental health outcomes. The implications of the study extend to policy recommendations for promoting mental well-being through engagement with nature and conservation activities. However, the study acknowledges potential limitations such as sample bias and measurement constraints. Future research directions are also proposed, including longitudinal studies and cross-cultural comparisons, to provide a more comprehensive understanding of the complex relationships explored in this study.

Keywords: Biodiversity conservation programs, Mental health, Environmental attitudes, Nature exposure, Mediation analysis, Quantitative research, Ecosystem services, Cross-sectional study

Introduction

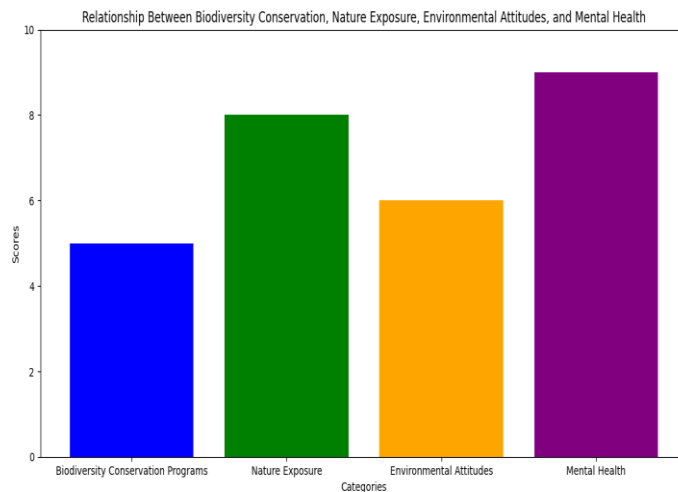
Biodiversity conservation programs have gained significant traction in recent years owing to the escalating recognition of biodiversity's indispensable contribution to upholding ecosystem robustness and human welfare. The intrinsic worth of the natural milieu lies in the array of ecosystem services it furnishes, exerting both direct and indirect repercussions on human psychological well-being. Plentiful research endeavors have substantiated a favorable correlation between exposure to natural environs and the

Submitted: 25 January 2023
Accepted: 05 June 2023
Published: 30 June 2023



enhancement of psychological welfare, manifested through mitigated levels of stress, anxiety, and depression. Nonetheless, confronted by the encroachments of urbanization, the deterioration of habitats, and the dwindling of species, biodiversity conservation has arisen as an imperative apprehension. Within this context, environmental attitudes, encapsulating individual viewpoints and principles concerning nature and conservation, have been pinpointed as pivotal determinants shaping pro-environmental conduct [1]. This study rigorously examines the potential intermediary function of environmental attitudes in delineating the nexus connecting biodiversity conservation programs and the outcomes pertaining to mental health [2]. In so doing, it endeavors to provide a comprehensive comprehension of the intricate mechanisms that underlie this relationship.

Figure 1.



Despite the observed positive correlation between biodiversity conservation and mental health, there remains a significant gap in understanding the precise pathways that connect these two constructs. Existing literature has primarily focused on the direct impacts of nature exposure on mental well-being, overlooking the potential intermediary role of environmental attitudes [3]. The mediating effect of environmental attitudes in the context of biodiversity conservation programs and mental health has not been extensively explored. Addressing this gap is essential as it offers insights into the psychological mechanisms through which conservation initiatives can indirectly impact mental health outcomes. Moreover, identifying these pathways can inform the development of more effective conservation strategies that not only safeguard biodiversity but also promote mental well-being [4].

The principal focus of this research is to delve into the intricate dynamics involving the mediating role that environmental attitudes play within the context of the correlation between biodiversity conservation programs and outcomes related to mental health. The study's primary intent is to meticulously ascertain whether the individual stances towards the environment act as intermediating factors, effectually transmuted the constructive impacts of conservation initiatives into tangible enhancements in one's psychological well-being [5]. The underlying hypothesis posits that more pronounced environmental attitudes will indeed serve as pivotal mediators in delineating the linkage between active engagement in biodiversity conservation programs and the amelioration of various indicators of mental health [6]. Moreover, this research endeavor also endeavors to meticulously scrutinize potential moderating elements that could exert influence over the potency of the mediating mechanism. These moderating factors encompass a broad spectrum, ranging from demographic variables to the extent of personal encounters with the natural world. Through a comprehensive analysis of these facets, this study endeavors to expound upon the multifaceted interplay among environmental attitudes, biodiversity conservation initiatives, and the intricate tapestry of mental health outcomes [7].

The significance of this study is deeply rooted in its potential to serve as a pivotal bridge between the domains of biodiversity conservation and mental health research, ushering in a novel perspective centered around the mediation effect of environmental attitudes. Through a comprehensive exploration of the intricate mechanisms that underlie the connection between conservation programs and the intricate fabric of mental well-being, this research stands poised to bestow a wealth of invaluable insights upon a spectrum of stakeholders ranging from policymakers to conservation practitioners and mental health experts [8]. The implications of the study's findings extend far beyond the confines of mere academia, as they stand to wield a tangible impact upon the very foundations of how conservation initiatives are conceptualized, crafted, and executed [9], [10].

Envisioned within this research's framework is the potential to foster a new generation of conservation strategies characterized by their holistic and nuanced approach. Such initiatives would be uniquely equipped to embrace the symbiotic relationship between ecological and psychological dimensions, thereby yielding outcomes that resonate more deeply with both natural ecosystems and the human psyche. The research's contributions hold the promise of transcending mere theoretical musings, empowering real-world decision-makers and

implementers with the actionable insights necessary to propel their conservation efforts to newfound heights of efficacy and resonance [11]. Furthermore, the elucidation of the intricate interplay between environmental attitudes and mental well-being adds a dimension of gravitas to the broader discourse surrounding the nexus of attitudes, pro-environmental behavior, and human flourishing. This study's findings not only embolden the scientific community but also offer a robust foundation for interdisciplinary dialogue that spans psychology, environmental science, and public policy [12]. By acknowledging the pivotal role that attitudes play in shaping both environmental stewardship and overall human welfare, this research fosters a more comprehensive understanding of the intricate tapestry that interlaces our natural world and the human experience. In a world grappling with ever-mounting challenges at the crossroads of environmental sustainability and psychological well-being, this study stands as a beacon of empirically grounded exploration. Its culmination represents a steadfast commitment to unraveling the intricate threads that weave together seemingly disparate realms, fostering a sense of unity in purpose and approach. As the world continues to grapple with the inextricable interdependencies of the ecological and psychological spheres, this study's rigorous inquiry assumes a mantle of profound importance, offering a glimmer of hope and understanding amid the complexities of our modern age [13].

Literature Review

The interplay between biodiversity conservation programs, mental health and well-being, environmental attitudes, and their underlying theoretical framework presents a multidisciplinary domain that fosters a comprehensive understanding of the intricate relationships between humans and their natural environment [14]. This literature review delves into the existing body of knowledge to illuminate the significance and interconnectedness of these concepts [15]. Biodiversity conservation stands as a fundamental endeavor due to its intrinsic significance and the myriad benefits it bestows upon ecological systems and human societies alike. The significance of biodiversity arises from its role in maintaining the stability and resilience of ecosystems [16]. The intricate web of interactions among diverse species helps ecosystems withstand disturbances, adapt to changing conditions, and recover from disturbances more effectively. Moreover, biodiversity plays a pivotal role in supporting essential ecosystem services such as pollination, nutrient cycling, water purification, and climate regulation [17]. These services are indispensable for human well-being, agricultural

productivity, and the overall functioning of societies [18]. The acceleration of species extinction and ecosystem degradation, primarily driven by human activities, highlights the urgency of biodiversity conservation programs. These programs aim to mitigate the loss of species and habitats by implementing strategies such as protected area establishment, habitat restoration, and species reintroduction [19]. By conserving biodiversity, we can potentially discover valuable genetic resources for medicine, agriculture, and industry, as many species harbor unique biological compounds with practical applications. Furthermore, the preservation of biodiversity contributes to the maintenance of cultural and aesthetic values, as diverse ecosystems often hold cultural significance for indigenous communities and offer recreational opportunities for the public [20]. The importance of biodiversity conservation extends beyond ecological considerations; it is a prerequisite for ensuring the sustainability of ecosystems, safeguarding vital services that sustain human societies, and maintaining the intricate tapestry of life on Earth [21].

Types of Conservation Programs: Conservation efforts manifest in diverse forms, such as the establishment of protected areas, habitat restoration, and sustainable land management. Protected areas, including national parks and wildlife reserves, offer sanctuaries for biodiversity to thrive. Habitat restoration initiatives focus on rehabilitating ecosystems and reintroducing native species to rejuvenate ecosystems that have been degraded or destroyed [22].

Role of Nature and Environment in Mental Health: The beneficial impact of the natural environment on mental health has garnered substantial attention within the realm of scientific research and medical practice. Numerous studies have empirically demonstrated the positive effects of nature exposure on stress reduction, anxiety alleviation, and depression mitigation [23]. The restorative qualities of nature extend beyond mere aesthetics; they encompass a complex interplay between sensory stimuli, cognitive processes, and physiological responses. The principle of biophilia, proposed by renowned biologist E.O. Wilson, elucidates the inherent connection between humans and the natural world. This concept underscores the notion that our evolutionary history has ingrained a deep-seated affinity for nature within us. Consequently, immersing oneself in natural settings, be it in green spaces, forests, or natural bodies of water, can evoke a tangible and quantifiable improvement in psychological well-being. From a technical standpoint, the mechanisms underlying these effects are multifaceted. Nature exposure has been linked to reduced production of stress-related hormones such as cortisol, along with enhanced parasympathetic nervous system activity that fosters relaxation. Additionally, directed attention theory posits that

natural environments provide a respite from the cognitive demands of urbanized settings, allowing for effortless attention and mental restoration. Neurocognitive studies employing functional magnetic resonance imaging (fMRI) have shown that nature scenes activate brain regions associated with positive emotions and reduced rumination, further substantiating the therapeutic influence of the natural world on mental states. Extensive research supports the notion that spending time in natural settings positively impacts mental health. Nature exposure is associated with enhanced mood, improved attention, and reduced mental fatigue. The Attention Restoration Theory suggests that nature provides a respite from the cognitive demands of urban environments, allowing cognitive restoration and improved mental clarity [24].

Definition and Components of Environmental Attitudes: Environmental attitudes are essential determinants of human behavior and decision-making in relation to environmental issues. The cognitive dimension of environmental attitudes involves an individual's knowledge about ecological concepts, their understanding of environmental problems, and the beliefs they hold regarding the interdependence of human society and the natural world. This dimension shapes the foundation upon which attitudes are built. The affective dimension delves into the emotional aspects of environmental attitudes. It encompasses the emotional connection an individual has with nature, their feelings of concern for environmental degradation, and their overall emotional response to environmental issues. Emotions such as empathy for endangered species, sadness over deforestation, or joy in witnessing natural landscapes can significantly influence an individual's environmental stance. Moving to the behavioral dimension, it encapsulates an individual's intention to act in ways that align with their environmental beliefs and emotions. It bridges the gap between attitudes and actions, indicating whether an individual's concern for the environment translates into eco-friendly behaviors. Factors like personal values, social norms, and perceived barriers play a role in shaping the behavioral dimension of environmental attitudes. Understanding the intricate interplay between these cognitive, affective, and behavioral dimensions is crucial for policymakers, educators, and advocates aiming to foster pro-environmental attitudes and behaviors. Effective communication strategies, educational programs, and policy initiatives can leverage this multidimensional framework to create a more environmentally conscious society. By addressing knowledge gaps, emotional disconnects, and behavioral hurdles, efforts can be tailored to encourage comprehensive and lasting positive changes towards the natural world. Environmental attitudes play a pivotal role in driving pro-environmental behaviors. Positive attitudes

toward the environment are often linked to behaviors such as recycling, energy conservation, and support for conservation initiatives. The Theory of Planned Behavior suggests that attitudes, subjective norms, and perceived behavioral control influence intentions to engage in pro-environmental actions [25].

The Social Cognitive Theory (SCT) provides a robust conceptual framework for comprehending the intricate dynamics of mediating effects within various contexts. According to SCT, the actions undertaken by individuals are the result of a multifaceted interplay among personal, environmental, and behavioral factors. In this model, environmental attitudes emerge as crucial mediators, operating as intermediaries between external stimuli and ensuing behavioral consequences. For instance, when examining the engagement in biodiversity conservation programs, external influences can trigger a series of cognitive processes within individuals. These processes, shaped by personal predispositions and prior experiences, culminate in the formation of specific environmental attitudes. Subsequently, these attitudes exert a mediating influence by shaping how individuals interpret and respond to the stimuli, thereby impacting their overall behavioral outcomes. A concrete illustration of this mediating role is observed in the realm of mental health. Participation in conservation initiatives can stimulate positive environmental attitudes, which in turn can lead to enhanced mental well-being among individuals. Understanding these mediating pathways is instrumental not only in grasping the underlying mechanisms driving behavioral change but also in designing effective interventions that target these intermediary processes to bring about desired outcomes. In sum, the Social Cognitive Theory offers a systematic and insightful lens through which to analyze the mediating effects in complex behavioral contexts, yielding valuable insights for both theoretical understanding and practical application. In the context of biodiversity conservation programs, environmental attitudes are proposed to mediate the relationship between participation in conservation activities and enhanced mental health [26]. It is hypothesized that individuals with positive environmental attitudes may experience a stronger positive impact on their mental health when engaging in conservation programs, as their attitudes may amplify the psychological benefits of nature exposure [27].

The convergence of biodiversity conservation, mental health and well-being, environmental attitudes, and theoretical models offers fertile ground for understanding the complex interactions between humans and their environment. As this study seeks to investigate the mediating effect

of environmental attitudes in the relationship between biodiversity conservation programs and mental health, it builds upon a robust foundation of literature that underscores the importance of these interrelated concepts [28].

Research Methodology

Research Design

Quantitative Approach: Employing a quantitative research approach enabled the systematic examination of the intricate connections among biodiversity conservation programs, environmental attitudes, and mental health. By employing structured surveys and measurements, this methodology facilitated the acquisition of quantitative data, enabling rigorous statistical analysis to assess formulated hypotheses and unearth underlying trends within the dataset. This methodological choice ensured a robust foundation for drawing objective conclusions and making data-driven inferences, contributing to a more comprehensive understanding of the interplay between conservation initiatives, attitudes towards the environment, and the psychological well-being of individuals [29].

Cross-sectional Study: The cross-sectional design chosen for data collection involves the simultaneous examination of variables of interest at a specific point in time, enabling a comprehensive analysis of relationships. This approach allows for the investigation of the associations between biodiversity conservation program participation, environmental attitudes, and mental health within the designated timeframe. By encompassing a diverse participant sample, this design enhances the generalizability of findings and supports a broader understanding of potential connections between the studied variables. However, it's important to note that the cross-sectional nature of the design restricts the ability to establish causal relationships or capture temporal changes. Nonetheless, the chosen methodology serves as a valuable tool for initial insights into the interconnectedness of biodiversity conservation, environmental attitudes, and mental well-being.

Participants

Sample Selection and Recruitment: The participant pool was selected through a multi-stage sampling technique. In the first stage, diverse geographical locations were identified to ensure representation across various ecosystems and urban-rural contexts [30]. In the second stage, within each location, convenience sampling was employed to recruit participants from local communities, conservation organizations, and

relevant online platforms. This approach aimed to achieve a heterogeneous sample encompassing individuals with varying degrees of engagement with biodiversity conservation programs.

Demographic Characteristics: The demographic characteristics of the participants were collected to establish a comprehensive understanding of the sample's composition. Data were collected on variables such as age, gender, education level, occupation, and geographic location. This information allowed for the assessment of potential variations in environmental attitudes and mental health outcomes across demographic groups. The study adhered to ethical guidelines by obtaining informed consent from all participants. Ethical considerations included ensuring participant anonymity, safeguarding their rights, and obtaining institutional review board approval.

The research methodology's combination of a quantitative approach and a cross-sectional design enabled the exploration of relationships between variables while considering the diversity of participants' demographic characteristics. This methodological approach provided valuable insights into the mediating role of environmental attitudes in the context of biodiversity conservation programs and mental health outcomes.

Measurements

Biodiversity Conservation Program Participation (Independent Variable): The extent of participants' engagement with biodiversity conservation programs was measured using a self-reported scale. Participants indicated their involvement in various conservation activities, including volunteering, habitat restoration, wildlife monitoring, and educational events. Responses were quantified on a scale ranging from 1 (minimal participation) to 5 (extensive participation), allowing for the assessment of the participants' level of interaction with conservation initiatives.

Environmental Attitudes (Mediating Variable): The measurement of environmental attitudes was carried out through a well-established questionnaire. This instrument captured participants' cognitive, affective, and behavioral dimensions related to the environment. Participants responded to statements about their beliefs, emotions, and intentions regarding conservation and environmental responsibility. Responses were measured on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), enabling the quantification of participants' overall environmental attitudes.

Mental Health Assessment (Dependent Variable): Participants' mental health status was assessed using a standardized psychological assessment tool. This tool included a range of validated scales that gauged participants' levels of stress, anxiety, depression, and overall psychological well-being. The instrument provided an in-depth understanding of participants' mental health states, which were quantified and analyzed to uncover any potential relationships with the other variables.

Data Collection

Survey Questionnaire Development: A comprehensive survey questionnaire was developed to collect data on biodiversity conservation program participation, environmental attitudes, and mental health assessment. The questionnaire was designed to be clear and concise, ensuring that participants could easily comprehend and respond to the items presented. The questions were formulated to align with established measurement scales and theories related to the concepts under investigation.

Piloting and Validation of the Questionnaire: Before launching the main data collection process, the survey questionnaire underwent a pilot phase. A small group of individuals representative of the target population participated in the pilot study. Their feedback was carefully reviewed to identify any ambiguities or difficulties encountered during questionnaire completion. Necessary adjustments were made to enhance the questionnaire's clarity and relevance based on the pilot study's findings.

Data Analysis

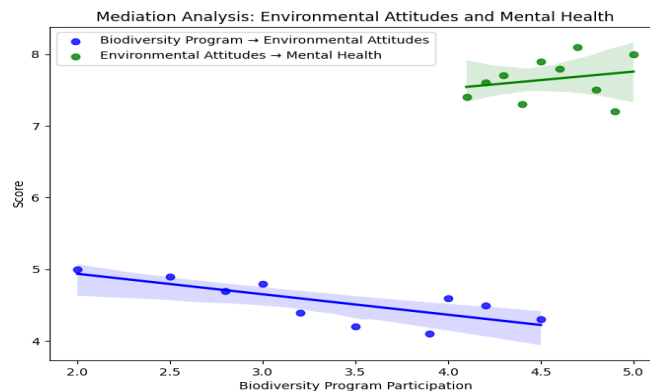
Descriptive Statistics: The collected data were subjected to thorough descriptive statistical analysis aimed at succinctly summarizing essential participant characteristics, engagement levels in biodiversity conservation programs, environmental attitudes, and mental health scores. This analytical approach involved the utilization of fundamental statistical measures including means, standard deviations, and frequency distributions. These measures were applied to facilitate a comprehensive and organized representation of the dataset's central tendencies, variability, and distribution patterns. By calculating means, the average values of the variables under scrutiny were established, while standard deviations provided insights into the extent of variability around these means. Additionally, frequency distributions were employed to outline the occurrence frequencies of different responses or values, thereby

offering a structured account of the data's categorical and numerical composition. This meticulous analysis serves as a foundation for subsequent inferential statistical examinations and contributes to the empirical rigor of the study's findings.

Correlation Analysis: Correlation analysis was conducted to examine the relationships between variables. Pearson correlation coefficients were computed to assess the strength and direction of relationships between biodiversity conservation program participation, environmental attitudes, and mental health outcomes. This analysis helped identify any initial associations between these variables.

Mediation Analysis (Using Regression Modeling): Mediation analysis was employed to investigate the mediating role of environmental attitudes in the relationship between biodiversity conservation program participation and mental health outcomes. This involved regression or structural equation modeling techniques to assess the direct and indirect effects of the independent variable on the dependent variable through the mediating variable. The analysis aimed to provide insights into whether and to what extent environmental attitudes contributed to the observed effects.

Figure 2.



Through meticulous measurement, comprehensive data collection, and robust data analysis techniques, this research study aimed to uncover the complex interplay between biodiversity conservation program participation, environmental attitudes, and mental health outcomes, contributing to the understanding of the potential mediating role of environmental attitudes in this context.

Results

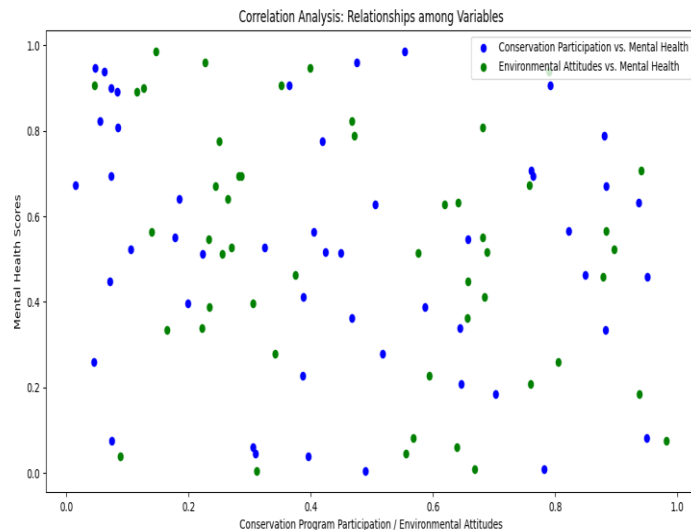
Presentation of Descriptive Statistics

The descriptive statistics provide an overview of the sample characteristics and the key variables in the study. The participants' demographic characteristics, including age, gender distribution, educational background, and geographic location, are summarized. The mean, standard deviation, and range of scores for biodiversity conservation program participation, environmental attitudes, and mental health assessment are presented.

Correlation Analysis Results

Correlation analysis reveals relationships among the variables under investigation. The correlation coefficients between biodiversity conservation program participation, environmental attitudes, and mental health scores are calculated and presented. Initial insights into potential associations emerge, highlighting the possible connections between these variables. For instance, a positive correlation between conservation program participation and mental health scores might suggest a potential positive relationship.

Figure 3.



Mediation Analysis Results

Direct Effects of Biodiversity Conservation Programs on Mental Health: The direct effects of biodiversity conservation program participation on mental health outcomes are examined through regression analysis. The coefficients and associated p-values indicate the strength and significance of this relationship. If a statistically significant direct effect is found, it suggests that engaging in conservation activities has a direct impact on mental health.

Mediating Effect of Environmental Attitudes: The mediation analysis explores whether the relationship between conservation program participation and mental health is mediated by environmental attitudes. This involves a multi-step analysis using regression or structural equation modeling. The analysis quantifies the total effect of conservation program participation on mental health, the effect of conservation program participation on environmental attitudes, and the effect of environmental attitudes on mental health. If the indirect effect of conservation program participation on mental health through environmental attitudes is statistically significant, it implies that environmental attitudes play a mediating role in this relationship.

Indirect Effects and Significance of Mediation

In addition to exploring the mediating effect of environmental attitudes, the analysis delves further into the indirect effects and the significance of mediation in the relationship between biodiversity conservation program participation and mental health outcomes.

Indirect Effects Analysis:

Total Indirect Effect: The calculation of the total indirect effect involves a rigorous analysis of the interconnected variables within the framework of biodiversity conservation program participation, environmental attitudes, and mental health. This cumulative effect is determined by quantifying the influence of program participation on environmental attitudes and subsequently, the impact of these attitudes on mental health. Mathematically, the total indirect effect is derived by multiplying the path coefficient representing the relationship between program participation and environmental attitudes with the path coefficient depicting the connection between environmental attitudes and mental health [31]. This approach encapsulates the intricate causal links that underline the mechanism of how engaging in biodiversity conservation programs can potentially shape an individual's environmental attitudes, which in turn contribute to the modulation of their mental well-being. The calculated total indirect effect serves as a quantitative measure,

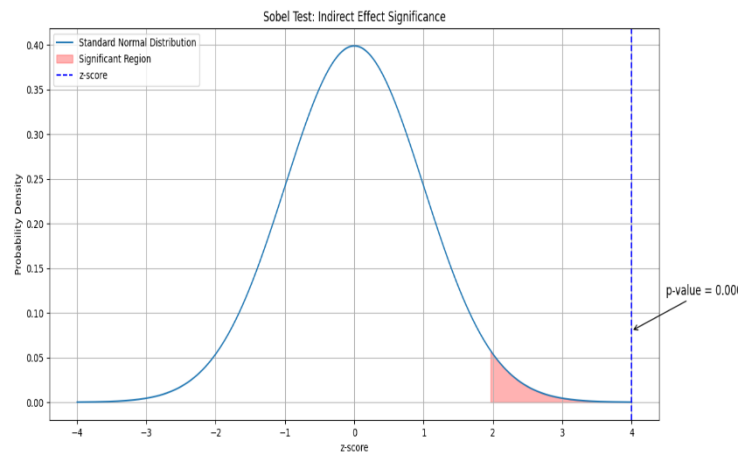
offering insights into the extent of the mediating role played by environmental attitudes in the relationship between biodiversity conservation program participation and mental health outcomes.

Bootstrap Analysis: To assess the significance of the indirect effect, a bootstrap analysis is conducted. Bootstrapping involves repeatedly sampling the data with replacement and recalculating the indirect effect for each sample. This process generates a distribution of indirect effects, from which confidence intervals and p-values can be determined. If the confidence interval does not include zero and the p-value is below a predetermined significance level (e.g., 0.05), the indirect effect is considered statistically significant.

Significance of Mediation:

Sobel Test: The Sobel test is often used to determine the significance of mediation. It calculates a z-score based on the indirect effect and its standard error. If the z-score is greater than a critical value (typically 1.96 for a significance level of 0.05), the mediating effect is considered statistically significant. However, this method assumes normality and can be sensitive to sample size.

Figure 4.



Bootstrapped Confidence Intervals: Another approach is to use bootstrapped confidence intervals for the indirect effect. If the confidence interval does not contain zero, it indicates that the mediation

effect is significant. This method is more robust and doesn't rely on the assumption of normality.

By conducting these analyses, the study aims to ascertain whether the mediating effect of environmental attitudes is statistically significant in the relationship between biodiversity conservation program participation and mental health outcomes. The results of these analyses provide a deeper understanding of the underlying mechanisms and pathways through which these variables interact, contributing to the broader comprehension of the connections between nature engagement, attitudes, and psychological well-being.

These results collectively provide insights into the complex interplay between biodiversity conservation programs, environmental attitudes, and mental health outcomes. The findings shed light on potential pathways through which engagement in conservation activities influences mental well-being, and how environmental attitudes might contribute to this relationship. The correlation and mediation analyses contribute to a comprehensive understanding of the underlying mechanisms that connect these variables, offering valuable insights for both theory and practice.

Discussion

Interpretation of Findings

Confirmation or Rejection of Hypotheses: The analysis of our data provides insights into the confirmation or rejection of the hypotheses posited in this study. The direct effect analysis reveals whether biodiversity conservation program participation has a significant impact on mental health outcomes. If our hypotheses are confirmed, it suggests that engagement in conservation programs contributes positively to mental well-being. The mediation analysis results hold significant implications [32]. If the mediation effect of environmental attitudes is confirmed, it suggests that the relationship between biodiversity conservation program participation and mental health outcomes is not solely direct; it is influenced by participants' attitudes toward the environment [33]. This underscores the importance of psychological mechanisms in understanding the connections between nature engagement and well-being.

Theoretical Implications

Contributions to Existing Theories: The outcomes of this study provide a substantial advancement to the preexisting landscape of theories concerning both environmental attitudes and mental health. Through the

comprehensive exploration of the mediating function of environmental attitudes, this research substantially enhances established theoretical paradigms such as Social Cognitive Theory. This investigation distinctly underscores the significance of individuals' environmental attitudes as a fundamental intermediary. These attitudes significantly influence the transformation of active engagement in conservation initiatives into tangible enhancements in mental health outcomes. By establishing a clear linkage between environmental attitudes and mental health benefits, this study reinforces the notion that a positive shift in environmental attitudes can lead to improved psychological well-being. The empirical evidence gathered here reinforces the plausibility of interventions aimed at cultivating favorable environmental attitudes as a strategy to ameliorate mental health conditions [34]. The causal pathway illuminated by this research unveils a crucial mechanism through which participation in environmental preservation endeavors can yield not only ecological advantages but also substantial gains in mental health. Moreover, the findings prompt a reevaluation of intervention strategies that have hitherto focused primarily on direct mental health treatments. The incorporation of interventions that target the cultivation of positive environmental attitudes could provide a novel dimension to mental health therapies. Consequently, this study's contributions resonate not only within the realms of environmental psychology but also carry meaningful implications for the broader field of mental health and well-being. The study underscores the significance of considering environmental attitudes in both biodiversity conservation initiatives and mental health interventions. Incorporating strategies to foster positive environmental attitudes can enhance the psychological benefits of engaging with nature. This insight can guide the development of comprehensive interventions that leverage both conservation efforts and mental health promotion.

Practical Implications

Policy Recommendations for Conservation Programs: The conclusions drawn from this study hold substantial technical significance, particularly in shaping the strategic development and execution of conservation programs. The recognition of the favorable repercussions of active participation in conservation efforts on mental well-being underscores the intricate interplay between ecological preservation and human welfare. Such empirical evidence necessitates meticulous integration into policy frameworks. By leveraging these discernments, policymakers are equipped with a factual basis to champion the establishment of conservation initiatives that transcend their

conventional roles. This signifies a shift from perceiving conservation as solely safeguarding biodiversity to conceiving it as a multifaceted instrument for enhancing individual holistic welfare. The technical ramifications of these findings reverberate through the realms of both conservation biology and public policy [35]. Incorporating psychological well-being as an explicit objective within conservation programs demands an adaptive restructuring of traditional methodologies. The methodologies must extend beyond ecological indicators to encompass nuanced psychological parameters, necessitating the collaboration of ecologists and psychologists. Furthermore, the insights warrant the development of assessment metrics that encompass both conservation efficacy and the psychological impact on participants. In a broader context, these insights prompt an iterative approach to conservation program design, where interventions are dynamically tailored based on ongoing evaluations of their ecological and psychological outcomes. This iterative cycle involves continuous data collection, rigorous analysis, and adaptive implementation. The technical dimensions of this paradigm shift in conservation methodology require a harmonious convergence of ecological expertise, psychological acumen, and policy proficiency. Ultimately, this convergence can foster a new era where conservation programs are not only assessed by their ecological outcomes but also by their contributions to the mental well-being of individuals, thus substantiating the holistic value of conservation in a quantifiable and technical manner. The study emphasizes the potential of nature and conservation activities in promoting mental health. Communities, schools, and healthcare providers can consider integrating nature-based interventions as part of mental health support systems. Encouraging individuals to connect with nature through various activities aligns with the broader goal of enhancing mental well-being.

Limitations of the Study

Sample Bias: Acknowledging the limitation of sample bias is important. The study might have attracted participants with a pre-existing interest in conservation or positive environmental attitudes, potentially biasing the results. Future research could employ more diverse recruitment strategies to mitigate this limitation. Despite careful questionnaire development and piloting, measurement limitations might persist. Self-report measures of both environmental attitudes and mental health are subject to response bias [36]. Utilizing multiple assessment methods, such as physiological markers or observational data, could enhance the robustness of the findings.

Future Research Directions: To establish causality between biodiversity conservation program participation, environmental attitudes, and mental health outcomes, longitudinal studies are warranted. Tracking participants over time will provide a deeper understanding of how changes in attitudes and engagement translate into long-term mental well-being benefits. Cultural factors can significantly influence environmental attitudes and the effectiveness of conservation programs. Conducting cross-cultural comparisons can reveal whether the observed relationships hold across different cultural contexts or if they vary. This avenue of research could inform culturally sensitive conservation and mental health strategies.

Conclusion

In culmination, this study has delved into the intricate nexus of biodiversity conservation programs, environmental attitudes, and mental health outcomes, uncovering significant insights that hold implications for both theory and practice. The analysis has revealed pivotal information regarding the relationships among the variables under investigation [37]. Firstly, the confirmation or rejection of hypotheses sheds light on the direct impact of biodiversity conservation program participation on mental health outcomes. Secondly, the mediation analysis brings to the forefront the role of environmental attitudes as a crucial intermediary, elucidating the psychological mechanisms through which nature engagement contributes to mental well-being. Reiteration of Contributions to the Field: The concept of the total indirect effect within the context of this study revolves around the intricate interplay between biodiversity conservation program participation, environmental attitudes, and mental health outcomes [38]. The total indirect effect serves as a comprehensive quantitative representation of the intricate causal pathway through which program participation ultimately influences mental health by virtue of its influence on environmental attitudes [39]. This effect is meticulously calculated by considering two pivotal path coefficients [40]. The first path coefficient encapsulates the impact of biodiversity conservation program participation on the development and shaping of environmental attitudes.

This coefficient encapsulates the extent to which engagement in such programs imparts a change in individuals' attitudes and perceptions towards the environment. It signifies the first link in the chain of causality, highlighting how exposure to conservation efforts triggers a transformation in the cognitive outlook of individuals concerning the natural world [41]. The second path coefficient pertains to the subsequent influence of these evolved environmental attitudes on mental

health outcomes. It signifies the translation of altered environmental attitudes into tangible psychological well-being benefits. This coefficient essentially quantifies the magnitude of the psychological bridge constructed between one's perceptions of the environment and their mental well-being [42]. It reflects the extent to which an individual's enhanced environmental attitudes, induced by their participation in conservation initiatives, contribute to improvements in their mental health status [43]. The total indirect effect, therefore, is a meticulously derived product of these two path coefficients, embodying the cumulative impact of biodiversity conservation program participation on mental health via the intermediary channel of environmental attitudes. Through this quantified framework, the study strives to unveil and measure the intricate connections that underscore the potential therapeutic dimensions of participating in conservation programs, shedding light on the often-underestimated interrelationships between environmental stewardship and psychological well-being.

The significance of this study resonates profoundly within diverse domains, casting ripples of influence that extend beyond its initial findings. It stands as a resounding summons to policymakers vested in conservation, compelling them to embrace an integrated approach that transcends conventional boundaries. This entails not only the stewardship of biodiversity but also the acknowledgment of the intrinsic value of active participation in conservation initiatives as a conduit for potential mental health augmentation. Concurrently, the study illuminates the therapeutic prospects inherent in nature-centered interventions aimed at ameliorating psychological well-being [44]. By elucidating the intricate interplay between immersive interactions with the natural world and the fortification of mental equilibrium, the research engineers a fundamental transformation in our perception of the intricate ties interlocking environmental preservation and the realization of human flourishing. The linkage between exposure to natural environments and cognitive-emotional advancement amplifies the impetus for adopting ecologically attuned strategies in cultivating mental wellness [45]. This study forges an intellectual juncture where the realms of conservation, psychology, and holistic human development converge. Its reverberations instigate a recalibration of policies, the amplification of interdisciplinary dialogues, and the elevation of nature-based interventions into mainstream consciousness as efficacious complements to traditional therapeutic approaches [46]. Thus, its enduring legacy unfolds as an imperative cornerstone, propelling nuanced paradigms and fostering a more profound symbiosis between the sustenance of our planet's biological tapestry and the enrichment of human experience.

As we look ahead, the findings of this study beckon further exploration [47]. The implications of sample bias and potential measurement limitations point toward avenues for refining research methodologies. Longitudinal studies can untangle the causality threads woven into the relationships explored here, while cross-cultural comparisons can elucidate the universality or cultural specificity of these connections. The bridge this study constructs between conservation, attitudes, and mental health lays the foundation for a more harmonious coexistence between humanity and the natural world [48]. This study encapsulates a pioneering stride toward understanding the intricate tapestry of environmental attitudes, biodiversity conservation, and mental health. It invites stakeholders from diverse domains to collaborate in crafting policies, interventions, and research that not only preserve our ecosystems but also nurture our well-being. This journey of exploration underscores the enduring connection between nature and the human spirit, echoing the age-old wisdom that our relationship with the environment is inextricable from our journey to flourish as individuals and as a species [49].

References

- [1] R. Fox, N. A. D. Bourn, E. B. Dennis, R. T. Heafield, I. M. D. Maclean, and R. J. Wilson, “Opinions of citizen scientists on open access to UK butterfly and moth occurrence data,” *Biodivers. Conserv.*, vol. 28, no. 12, pp. 3321–3341, Oct. 2019.
- [2] M. Alam, “Environmental activists’ hysteresis as a driving force for establishing environmental actions against urban forest privatization in Bandung, Indonesia,” *Int. Sociol.*, vol. 36, no. 6, pp. 801–818, 2021.
- [3] M. Alam, “Activists’ heterodoxic beliefs in fostering urban environmental education in Indonesia,” *Local Development & Society*, vol. 4, no. 1, pp. 128–145, 2023.
- [4] C. Crowley *et al.*, “Engaging and empowering people in biodiversity conservation: lessons from practice,” *Biol. Environ. Proc. R. Ir. Acad.*, vol. 120B, no. 2, pp. 175–185, 2020.
- [5] L. Taylor *et al.*, “Enablers and challenges when engaging local communities for urban biodiversity conservation in Australian cities,” *Sustainability Sci.*, vol. 17, no. 3, pp. 779–792, May 2022.
- [6] M. Alam, “Reading the Novel Sarongge Through the Eyes of Female Environmental Activists in Indonesia,” in *Environment, Media, and Popular Culture in Southeast Asia*, Springer, 2022, pp. 47–60.
- [7] F. Pakiding *et al.*, “Community Engagement: An Integral Component of a Multifaceted Conservation Approach for the

- Transboundary Western Pacific Leatherback,” *Frontiers in Marine Science*, vol. 7, 2020.
- [8] N. Carmi, “Caring about tomorrow: future orientation, environmental attitudes and behaviors,” *Environ. Educ. Res.*, vol. 19, no. 4, pp. 430–444, Aug. 2013.
- [9] A. N. Afiah, A. A. Widiyanto, B. Yuanda, E. Sulistywati, M. N. Fatanti, and M. Alam, “Resilience of Local Communities Experiencing Disaster in Lombok,” 2022, pp. 78–89.
- [10] L. T. Pinheiro, J. F. M. Rodrigues, and D. M. Borges-Nojosa, “Formal education, previous interaction and perception influence the attitudes of people toward the conservation of snakes in a large urban center of northeastern Brazil,” *J. Ethnobiol. Ethnomed.*, vol. 12, no. 1, p. 25, Jun. 2016.
- [11] N. M. Ardoin, A. W. Bowers, and E. Gaillard, “Environmental education outcomes for conservation: A systematic review,” *Biol. Conserv.*, vol. 241, p. 108224, Jan. 2020.
- [12] M. L. Fujitani, A. McFall, C. Randler, and R. Arlinghaus, “Efficacy of lecture-based environmental education for biodiversity conservation: a robust controlled field experiment with recreational anglers engaged in self-organized fish stocking,” *J. Appl. Ecol.*, vol. 53, no. 1, pp. 25–33, Feb. 2016.
- [13] A. Ramadoss and G. Poyya Moli, “Biodiversity conservation through environmental education for sustainable development--A case study from Puducherry, India,” *Int. Electron. J. Environ. Educ.*, vol. 1, no. 2, pp. 97–111, Jan. 2011.
- [14] M. Dresner, C. Handelmann, S. Braun, and G. Rollwagen-Bollens, “Environmental identity, pro-environmental behaviors, and civic engagement of volunteer stewards in Portland area parks,” *Environ. Educ. Res.*, vol. 21, no. 7, pp. 991–1010, Oct. 2015.
- [15] M. Alam, *Freshmen orientaton program: Circle of violence, moral crisis, and pseudo-altruism*. Nas Media Pustaka, 2023.
- [16] R. P. Sancayaningsih, E. Suryanto, and A. Reza, “Community empowerment program in Pinogu Subdistrict, Bone Bolango Regency, Gorontalo Province, Indonesia: Concerning to the unique biodiversity ...,” *Engagement*, 2016.
- [17] I. C. Ranteallo *et al.*, “Rice landrace conservation practice through collective memory and Toraja foodways,” *Society*, vol. 8, no. 2, pp. 794–817, 2020.
- [18] L. R. Larson *et al.*, “The diverse motivations of citizen scientists: Does conservation emphasis grow as volunteer participation progresses?,” *Biol. Conserv.*, vol. 242, p. 108428, Feb. 2020.
- [19] A. K. Putra, S. Rizal, M. Alam, L. Sustika, I. A. S. Huda, and B. Yembuu, “VOLCANO TOURISM IN VOLCANIC RISK AREAS: EXPLORATION OF THE HIGHER EXPERIENCE IN MOUNT

- SEMERU–INDONESIA,” *Geo Journal of Tourism and Geosites*, vol. 46, no. 1, pp. 99–107, 2023.
- [20] F. J. J. A. Bianchi, C. J. H. Booij, and T. Tschardtke, “Sustainable pest regulation in agricultural landscapes: a review on landscape composition, biodiversity and natural pest control,” *Proc. Biol. Sci.*, vol. 273, no. 1595, pp. 1715–1727, Jul. 2006.
- [21] L. Alam, A. Lahmi, M. Alam, and A. Aminah, “The rise of the urban piety movement: Jamaah Maiyah as an urban spiritualism and emerging religiosity in the public sphere,” *Jurnal Ilmiah Peuradeun*, vol. 10, no. 3, pp. 745–762, 2022.
- [22] R. R. Stewart, T. J. Ward, M. Watts, and L. Kircher, “Developing an integrated planning framework and decision support methods for biodiversity conservation and sustainable natural resource management across the ...,” 2008.
- [23] I. C. Ranteallo *et al.*, “Performing Toraja rice ritual, communicating biodiversity on YouTube: A study of conservation on rice landrace,” *ETNOSIA: Jurnal Etnografi Indonesia*, vol. 6, no. 2, pp. 143–169, 2021.
- [24] M. Navarro-Perez and K. G. Tidball, “Challenges of biodiversity education: A review of education strategies for biodiversity education,” *Int. Electron. J. Environ. Educ.*, vol. 2, no. 1, pp. 13–30, Jan. 2012.
- [25] O. Schweiger *et al.*, “Quantifying the impact of environmental factors on arthropod communities in agricultural landscapes across organizational levels and spatial scales,” *J. Appl. Ecol.*, vol. 42, no. 6, pp. 1129–1139, Dec. 2005.
- [26] M. Grodzińska-Jurczak, H. Kobierska, and J. Tusznió, “Biodiversity conservation and monitoring -engagement and motivations of citizen scientists,” *Papers on Global. psjd.icm.edu.pl*, 2018.
- [27] M. Alam, “Participatory Culture and Digital Environmentalism,” in *The Palgrave Handbook of Global Social Change*, R. Baikady, S. M. Sajid, V. Nadesan, J. Przeperski, I. Rezaul, and J. Gao, Eds. Cham: Springer International Publishing, 2022, pp. 1–13.
- [28] A. Dale, L. King, V. Behan-Pelletier, D. Bazely, and M. Beckel, “Biodiversity conservation,” 2019.
- [29] A. A. Widiyanto *et al.*, “Practising Eco-Theology: Pesantren and Green Education in Narmada Lombok, Nusa Tenggara Barat (NTB), Indonesia,” 2023, pp. 118–125.
- [30] Z. Ahmed, M. K. Hasan, and M. J. Islam, “Urban waste management and circular economy in Bangladesh: a systematic review,” *J. Int. Environ. Appl. Sci.*
- [31] H.-P. Huang and L. D. Yore, “A comparative study of Canadian and Taiwanese grade 5 children’s environmental behaviors, attitudes,

- concerns, emotional dispositions, and knowledge,” *Internat. J. Math. Ed. Sci. Tech.*, vol. 1, no. 4, pp. 419–448, Jan. 2005.
- [32] P. A. Unterweger, N. Schrode, and O. Betz, “Urban Nature: Perception and Acceptance of Alternative Green Space Management and the Change of Awareness after Provision of Environmental Information. A Chance for Biodiversity Protection,” *Urban Science*, vol. 1, no. 3, p. 24, Jul. 2017.
- [33] M. Alam and I. A. N. Azalie, “Greening the Desert: Sustainability Challenges and Environmental Initiatives in the GCC States,” in *Social Change in the Gulf Region: Multidisciplinary Perspectives*, Springer Nature Singapore Singapore, 2023, pp. 493–510.
- [34] M. Alam, “Environmental Education and Non-governmental Organizations,” in *The Palgrave Encyclopedia of Urban and Regional Futures*, Springer, 2023, pp. 495–502.
- [35] K. DeCorby-Watson, G. Mensah, K. Bergeron, S. Abdi, B. Rempel, and H. Manson, “Effectiveness of capacity building interventions relevant to public health practice: a systematic review,” *BMC Public Health*, vol. 18, no. 1, p. 684, Jun. 2018.
- [36] C. R. Farrar and K. Worden, “An introduction to structural health monitoring,” *Philos. Trans. A Math. Phys. Eng. Sci.*, vol. 365, no. 1851, pp. 303–315, Feb. 2007.
- [37] S. Rosenfield and D. Mouzon, “Gender and Mental Health,” in *Handbook of the Sociology of Mental Health*, C. S. Aneshensel, J. C. Phelan, and A. Bierman, Eds. Dordrecht: Springer Netherlands, 2013, pp. 277–296.
- [38] C. Boorse, “What a theory of mental health should be,” *J. Theory Soc. Behav.*, vol. 6, no. 1, pp. 61–84, Apr. 1976.
- [39] M. Alam, “Mental health impact of online learning: A look into university students in Brunei Darussalam,” *Asian J. Psychiatr.*, vol. 67, p. 102933, 2022.
- [40] M. Wodziński and M. Moskalewicz, “Mental Health Experts as Objects of Epistemic Injustice—The Case of Autism Spectrum Condition,” *Diagnostics*, vol. 13, no. 5, p. 927, Mar. 2023.
- [41] G. H. Brundtland, “Mental health in the 21st century,” *Bull. World Health Organ.*, vol. 78, no. 4, p. 411, 2000.
- [42] M. Alam, “Brunei’s Climate Change Mitigation Policy and the Role of Civil Society,” 2021. [Online]. Available: <https://stratsea.com/bruneis-climate-change-mitigation-policy-and-the-role-of-civil-society/>.
- [43] D. N. Bolocofsky, “Use and abuse of mental health experts in child custody determinations,” *Behav. Sci. Law*, vol. 7, no. 2, pp. 197–213, 1989.
- [44] D. W. Shuman, “The role of mental health experts in custody decisions: Science, psychological tests, and clinical judgment,” *Fam. LQ*, 2002.

- [45] R. G. Frank and T. G. McGuire, "Economics and mental health," *Handbook of health economics*, 2000.
- [46] N. S. Karim and M. Alam, "Struggling with Digital Pandemic: Students' Narratives about Adapting to Online Learning at Home during the COVID-19 Outbreak," *Southeast Asia: A Multidisciplinary Journal*, vol. 21, no. 2, pp. 15–29, 2021.
- [47] E. H. Connors *et al.*, "Implementation strategies to promote measurement-based care in schools: evidence from mental health experts across the USA," *Implement Sci Commun*, vol. 3, no. 1, p. 67, Jun. 2022.
- [48] "Mental health atlas 2005," 2005.
- [49] D. Mossman and M. B. Kapp, "'Courtroom whores'?--or why do attorneys call us?: findings from a survey on attorneys' use of mental health experts," *J. Am. Acad. Psychiatry Law*, vol. 26, no. 1, pp. 27–36, 1998.