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THE IMPACT OF GREEN SPACES TO HUMAN PSYCHOLOGY AND THEIR MENTAL HEALTH.

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Abstract

With rapid urbanization, the increasing separation between humans and the natural environment is exacerbating mental health challenges. Research shows that contact with the natural environment yields significant psychological benefits. However, existing theories have limitations in sample diversity and explanatory power. This study reviewed and tested five major theoretical frameworks, aiming to develop a new interdisciplinary theoretical framework. Using a questionnaire, data from 413 participants were analyzed via structural equation modeling. The results confirmed the important roles of physiological and cognitive effects, and psychological needs satisfaction, in how the natural environment influences mental health. This research created a progressive theoretical framework that integrates these findings, enhancing understanding of the complex mechanisms by which nature affects mental health and informing urban planning. Future research, based on this framework and involving larger samples, will aim to develop a more comprehensive theoretical system.

Keywords: Natural Environment, Mental Health

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INTRODUCTION

The world is rapidly urbanizing, with United Nations projections showing nearly 68% of the global population living in urban areas by 2050 (UnitedNations, 2018). This shift has brought significant public health challenges, particularly the growing severity of mental health issues such as depression and anxiety, attributed partly to reduced contact with the natural environment (Herchet et al., 2022). Urban lifestyle factors, including a fast pace, high competition, and weakened social support, also contribute to increased mental health problems among city dwellers (Moreira et al., 2022).

In fact, substantial research evidence indicates that contact with the natural environment can bring a range of benefits to human psychological health (Astell-Burt & Feng, 2019; Bratman et al., 2021; Herchet et al., 2022; Klein et al., 2022; Latip et al., 2023). These positive effects include relieving stress and negative emotions, improving attentional capacity, enhancing immune system functions, and increasing subjective life satisfaction (Bratman et al., 2021; Herchet et al., 2022; Jones et al., 2021; Schertz & Berman, 2019). These benefits arise from various forms of nature experience like outdoor activities, viewing natural scenery, immersion in natural settings, and listening to natural sounds (Herchet et al., 2022; Jones et al., 2021).

Specifically in psychological aspects, interacting with nature has been shown to improve cognitive abilities like working memory, attentional control, and cognitive flexibility, as well as alleviating depression, anxiety, and increasing life satisfaction (Astell-Burt & Feng, 2019; Bratman et al., 2021; Klein et al., 2022; Schertz & Berman, 2019).

Among the positive effects above, the beneficial impacts of urban green spaces, as the primary daily natural ecosystems in the urban environment, on residents' mental health have received much attention and been widely validated (Lim et al., 2023). Major findings show that various forms of contact with urban greenery are closely associated with improved psychological health (Astell-Burt & Feng, 2019; Klein et al., 2022). For instance, residents living in communities with more green spaces, or closer to parks and other greenery, report higher levels of mental health and lower incidence rates of psychological disorders like depression (Klein et al., 2022).

Despite substantial evidence for the positive impacts of urban green spaces on mental health, deficiencies remain in related research and theoretical explanations. First, most existing studies utilize cross-sectional designs (Feng et al., 2022; Hubbard et al., 2021; Qiao et al., 2021; Ribeiro et al., 2021), which cannot rule out the influence of confounds like selection bias, making it difficult to establish causal relationships between greenery and mental health. This needs to be verified through prospective cohort studies. Second, current theories mostly stay at the psychological level, seldom considering relevant biological mechanisms, which requires more rigorous testing with biological indicators

(Herchet et al., 2022). Third, different types of green spaces like parks (Bustamante et al., 2022; Zhu et al., 2022), community gardens (Tae et al., 2022), and green roofs (J. Lee et al., 2022) differ in structure and function, so their mechanisms on mental health may also differ, but comparative research is still lacking. This calls for more extensive comparisons across types. Fourth, current theories pay little attention to individual differences like age and cultural background as moderators (Meuwese et al., 2021; Phuoc Nguyen & Nguyen, 2022), which need verification across different populations.

Therefore, it is necessary to conduct a comprehensive review and examination of existing theories, clarifying their contributions, deficiencies and directions for improvement, in order to establish a new multi-disciplinary theoretical framework to guide urban green space planning practices. The key to achieving this goal lies in systematically testing different theoretical perspectives to identify paths for theoretical integration and expansion, ultimately developing a new theoretical system with greater explanatory power.

Based on the current research landscape, the primary aim of this study is to review theories concerning the impacts of green spaces on mental health restoration, comparing different theories regarding their applicability, explanatory strengths and weaknesses, clarifying paths for integration and expansion, to lay the theoretical foundations for a new multi-disciplinary framework.

This study aims to provide a solid basis for developing a more comprehensive and rigorous new theory through a systematic review of current theories, clarifying the current status and deficiencies to propel rapid developments in this research field. This will not only benefit the field's growth, but also provide scientific guidance for designing public spaces that optimize the psychological benefits of urban greenery. Certainly, as an exploratory theoretical study, this research has its limitations, and the proposed new framework will need continual refinement in follow-up studies. However, this systematic theoretical examination will facilitate the maturation and progress of this emerging interdisciplinary field.

LITERATURE REVIEW

Five principal theoretical frameworks have been identified in the domain of the positive effects of natural environments on psychological health: attention restoration theory, stress reduction theory, biophilia hypothesis, self-determination theory, and flow experience theory.

Attention Restoration Theory, proposed by Rachel and Stephen Kaplan in 1989, posits that natural environments help restore human attentional resources (Kaplan & Kaplan, 1989). Empirical studies confirm its effects but also suggest it may not be universally applicable (Cassarino et al., 2019; Trammell & Aguilar, 2021). Stress Reduction Theory, introduced by Roger Ulrich et al. in 1991, claims

that natural environments mitigate physiological stress responses (Ulrich et al., 1991). While supported by empirical studies, the theory lacks deep explanatory mechanisms (Escolà-Gascón & Houran, 2021). Biophilia Hypothesis, conceptualized by Edward Wilson in the 1980s, suggests an innate connection between humans and nature (Wilson, 1986). However, the specific mechanisms behind this connection remain ambiguous. Self-Determination Theory, by Ryan and Deci in 1985, emphasizes the satisfaction of three basic psychological needs—autonomy, competence, and relatedness (Deci & Ryan, 1985). It posits that natural environments can enhance subjective well-being by fulfilling these needs. Flow Experience Theory, proposed by Csikszentmihalyi in 1990, emphasizes the positive emotional experiences derived from total engagement in activities (Csikszentmihalyi, 1990). The theory's application has been limited by its consideration of individual differences (Wang et al., 2023)

Tables 1 & 2 provide concise overviews of the core points, advantages, and limitations of each theory, as well as their interconnections.

Table 1: Core perspectives and limitations of each theory

Theory Name	Core Points	Application Advantages	Limitations	References
Attention Restoration Theory	Natural environments can restore attention	Emphasizes cognitive aspects	Does not account for individual differences	(Cassarino et al., 2019; Trammell & Aguilar, 2021; van den Berg, 2021)
Stress Reduction Theory	Natural environments have stress-reducing physiological effects	Emphasizes physiological mechanisms	Overlooks the factor of subjective cognition in stress reduction	(Escolà-Gascón & Houran, 2021; Herchet et al., 2022)
Biophilia Hypothesis	There is an inherent connection between humans and nature	Provides an evolutionary perspective	Fails to consider differing effects of various natural environments	(Bratman et al., 2019; Brymer et al., 2021; Herchet et al., 2022)
Self-Determination Theory	Satisfies basic psychological needs	Concerns higher-level psychological needs	Does not fully account for diverse psychological needs across varied natural settings and individual differences	(Landon et al., 2021; E. S. Lee et al., 2022; Yang et al., 2022)
Flow Theory	Nature environments provide subjective pleasant experiences	Focuses on emotional aspects	Overvalues subjective agency, underestimates nature's role	(Xie et al., 2022)

Table 2: Connections and differences among theories

Theory Name	Connection with other theories	Difference from other theories
Attention Restoration Theory	Shared emphasis on direct effects of nature with Stress Reduction Theory	Focuses on cognitive effects (Kaplan, 1995), whereas Stress Reduction Theory emphasizes physiological effects (Ulrich et al., 1991)
Stress Reduction Theory	Shared emphasis on direct effects of nature with Attention Restoration Theory	Focuses on physiological effects (Ulrich et al., 1991), whereas Attention Restoration Theory emphasizes cognitive effects (Kaplan, 1995)
Biophilia Hypothesis	Provides common basis and starting point for other theories	Other theories limited to psychological and physiological systems (Csikszentmihalyi, 1990; Kaplan, 1995; Ryan & Deci, 2000; Ulrich et al., 1991), whereas Biophilia Hypothesis examines human-nature relationship (Wilson, 1986)
Self-Determination Theory	Builds on fulfillment of lower-level needs to address higher-level needs	More focused on psychological needs (Ryan & Deci, 2000), whereas Attention Restoration Theory and Stress Reduction Theory are more foundational (Kaplan, 1995; Ulrich et al., 1991)
Flow Theory	Also examines impact of nature on positive affect	More focused on subjective emotional experiences (Csikszentmihalyi, 1990), while other theories are more objective

Building on these theories, this study introduces a multi-theoretical cyclical framework, encompassing four stages: natural affinity, physiological-cognitive benefits, psychological need satisfaction, and positive emotional experiences. This framework aims to present a comprehensive explanation of the mechanisms through which natural environments influence psychological well-being, emphasizing the interplay and amplification among the effects.

While the proposed framework offers a more comprehensive viewpoint than individual theories, it requires further validation and refinement. This study paves the way for future research, aiming for a robust interdisciplinary theoretical system that can inform urban planning and the promotion of public psychological well-being

METHODOLOGY

Research design and sample selection

The study employs quantitative research, targeting residents of Shanghai, China. As an economic center (Wei et al., 2022), Shanghai's rapid urbanization (Wu et al., 2019) and the fast pace of life present distinctive stressors, offering representative significance. Random sampling was utilized to select a diverse cross-section of the population across age, gender, occupation, and residential areas to ensure the representativeness and applicability of the findings.

Questionnaire Development

The core objective is to validate and support a newly proposed theoretical framework. A questionnaire was developed to gather data for testing this framework.

The questionnaire, grounded in previous research and new exploratory queries, comprises key sections aimed at delving deeper into the connection with nature, psychological restoration experiences, levels of physiological relaxation, satisfaction of basic psychological needs, and positive emotional experiences.

Table 3 provides an overview of the questionnaire sections, including their sources, objectives, and sample questions.

Table 3: Overview of Questionnaire Components and Sample Items

Section of Questionnaire	Source and Custom Items	Purpose	Sample Item
Nature Relatedness Scale (NRS)	Partially based onMayer and Frantz (2004), with added custom items	To assess the degree of participants' connection with nature	I often feel a sense of oneness with the natural world
Psychological Restoration Scale (PRS)	Partly derived from Korpela et al. (2010), with additional custom questions	To holistically evaluate experiences of psychological restoration	In natural settings, I feel my attention is rejuvenated
Physiological Relaxation Scale	Entirely self-designed	To quantify participants' levels of physiological relaxation	In this environment, my breathing rhythm feels
Basic Psychological Needs Satisfaction Scale (BPNS)	Integrating items from Vlachopoulos (2008) with custom questions	To assess how natural environments meet fundamental psychological needs	In natural environments, I perceive my choices to be autonomous
Positive Affect Scale (PANAS)	Employing the scale designed by Watson et al. (1988)	To measure participants' positive emotional experiences	In natural settings, the extent of my ‘excitement’ emotion is
Reciprocal Mechanism Section	Completely self-designed	To deeply explore how natural environments influence emotions and connection to nature	Natural environments intensify my bond with nature

Data Collection

A random sample survey was executed in Shanghai, resulting in 413 valid questionnaire responses. To ensure the precision and integrity of our data, we incorporated several diagnostic questions within the questionnaire to discern the earnestness of the respondents' participation. Utilizing these control items, we were able to sift out responses that lacked due diligence, thus securing the quality of our data. Additionally, to further vouch for data quality, a brief overview of the survey's intent and content was presented to all respondents prior to their participation.

Data Validation

To ensure the rigor of the measurement model, both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were executed using AMOS.

Based on model diagnostics, several items were refined to optimize the model's fit. The salient validation metrics derived from this analysis include.

Table 4. Confirmatory Factor Analysis Results

Dimension	**Item**		**Parameter significance estimation**				**Factor loading**	**Item reliability**	**Composite reliability**	**Convergent validity**
			Unstd Estimate	S.E.	T-value	P	Std Estimate	SMC	CR	AVE
NR1	N1	<--	1.000				.631	.398	.828	.549
	N4	<--	1.067	.087	12.271	***	.798	.637		
	N5	<--	1.238	.100	12.389	***	.817	.667		
	N6	<--	1.000	.088	11.324	***	.702	.493		
PCB	PR1	<--	1.000				.741	.549	.847	.586
	PR2	<--	1,075	.065	16.413	***	.877	.769		
	PR3	<--	1.024	.065	15.826	***	.819	.671		
	PR7	<--	.633	.055	11.505	***	.596	.355		
ANF	A2	<--	1.000				.819	.671	.824	.611
	A3	<--	.893	.075	11.861	***	.803	.645		
	A5	<--	.920	.077	11.955	***	.719	.517		
PEE	EM1	<--	1.000				.821	.674	.859	.604
	EM2	<--	.817	.050	16.230	***	.785	.616		
	EM3	<--	.805	.054	14.844	***	.716	.513		
	EM4	<--	.919	.056	16.366	***	.782	.612		
NR2	C1	<--	1.000				.791	.626	.861	.674
	C2	<--	1.064	.063	16.945	***	.870	.757		
	C3	<--	.929	.057	16.400	***	.800	.640		

Factor Loadings: All item factor loadings consistently surpassed the recommended threshold of 0.6, denoting a robust association with their respective latent variables (Hair, 2009).

Item Reliability: The squared multiple correlations (SMC) for each item elucidated the reliability of individual items in relation to their assigned factors.

Composite Reliability: The composite reliability (CR) of all latent variables uniformly exceeded the advocated benchmark of 0.7, indicating commendable internal consistency (Nunally, 1978).

Convergent Validity: The average variance extracted (AVE) for each latent variable consistently surpassed the 0.5 benchmark, underscoring satisfactory convergent validity (Fornell & Larcker, 1981).

Furthermore, an inter-construct correlation analysis was conducted. Based on the comparisons between the square root of AVEs and the inter-correlations among constructs, multicollinearity was determined to be non-significant (Fornell & Larcker, 1981).

Table 5 offers a condensed view of the inter-construct correlation matrix. The diagonal values represent the square root of the average variance extracted (AVE) for each construct, while the off-diagonal values showcase the correlations between the constructs. As can be observed, the diagonal values (square root of AVEs) are consistently greater than the inter-construct correlations, validating the discriminant validity of our constructs.

Table 5. Correlation Matrix of Latent Constructs

	AVE	NR2	PEE	ANF	PCB	NR1
NR2	.674	**.821**				
PEE	.604	.639	**.777**			
ANF	.611	.588	.775	**.782**		
PCB	.586	.656	.706	.685	**.766**	
NR1	.549	.670	.658	.721	.678	**.741**

RESULTS

Model Fit

To validate our research model, we employed AMOS software for structural equation model analysis.

The Chi-square statistic is traditionally used to evaluate the level of inconsistency between the model and observed data (Curran et al., 2002). A lower Chi-square value suggests a smaller discrepancy. In our study, the Chi-square was 341.644 with 129 degrees of freedom, resulting in a Chi-square/degrees of freedom ratio of 2.648, indicating a good overall model fit.

Goodness-of-fit index (GFI), a metric that reflects the extent to which the model explains the variance covariance of the observed data (Mulaik et al., 1989). Values range from 0 to 1, with values close to 1 indicating excellent model fit. The GFI in this study was .915, indicating excellent model fit.

The Adjusted Goodness of Fit Index (AGFI) accounts for the degrees of freedom in the model, reflecting the impact of the model's complexity on its fit. Values close to 1 indicate a better fit (West et al., 2012). In this study, the AGFI value reached 0.887, which further supports the adequacy of the model fit.

The Comparative Fit Index (CFI) compares the actual model fit to a baseline model, with values nearing 1 indicating a good relative fit (West et al., 2012). The CFI in our research was notably high at 0.946, significantly surpassing the 0.9 standard and evidencing considerable improvement over an independent model, indicative of a very good fit.

The Root Mean Square Error of Approximation (RMSEA) evaluates the magnitude of error in the model, with values between 0.05 and 0.08 indicating an acceptable fit (West et al., 2012). Our study reported an RMSEA of 0.063, below the critical value of 0.08, demonstrating that the fitting model aptly reflects the structure of the sample data.

Taken together, these fit indices have achieved a favorable level, suggesting that the measurement model effectively represents the relationships between the latent variables and the measured variables, displaying a good fit.

Mediation Effect Analysis

Given the theoretical framework's emphasis on the sequential influence from natural affinity to positive emotional experiences, two potential mediators, physiological cognitive effects and psychological needs satisfaction, were examined. Both mediators were hypothesized to serve pivotal roles in translating the basic relationship with nature into tangible psychological benefits:

Physiological Cognitive Effects: Rooted in the Attention Restoration Theory and Stress Reduction Theory, this variable is expected to account for the immediate cognitive and physiological impacts of natural exposure, serving as a bridge to more enduring psychological benefits.

Psychological Needs Satisfaction: Drawing from the Self-Determination Theory, this variable captures the degree to which natural environments cater to our intrinsic psychological needs, ultimately fostering positive emotional experiences.

For mediation analysis, the focus was on the indirect effects. Point estimates provide the size of the mediation effect, while the confidence interval offers a range within which the true mediation effect lies. Using a 95% confidence level ensures that we are 95% confident that the true mediation effect lies within the stated interval. This is a standard practice in research to balance the trade-off between precision and confidence. The mediation effect of physiological cognitive effects had a point estimate of 0.337, with a confidence interval between 0.199 and 0.493. The mediation effect of psychological needs satisfaction had a point estimate of 0.43, with a confidence interval ranging from 0.261 to 0.7. The difference in their mediation effects produced a point estimate of 0.094, with a confidence interval that included zero, indicating no significant difference between the two effects (MacKinnon et al., 1995).

Table 5: Mediation Effect Analysis

SIE	Point Estimation	Product of coef.		Bias-corrected		Percentile	
		SE	Z	Lower	Upper	Lower	Upper
NR1→PCB→PEE	0.337	0.075	4.493	0.199	0.493	0.201	0.493
NR1→ANF→PEE	0.43	0.107	4.019	0.261	0.7	0.254	0.689
IE difference	0.094	0.125	0.752	-0.123	0.371	-0.129	0.361

In detail, the point estimate of 0.337 for the mediation effect of physiological cognitive effects, with a 95% confidence interval between 0.199 and 0.493 excluding zero, signifies its statistical significance (Shrout & Bolger,

2002). The point estimate of 0.43 for the mediation effect of psychological needs satisfaction, with its 95% confidence interval ranging from 0.261 to 0.7, also excludes zero, further denoting its statistical significance. The comparison of their effects, with a point estimate difference of 0.094 and a confidence interval that encompasses zero, indicates their similar strength in mediating the relationship.

In summary, both physiological cognitive effects and psychological needs satisfaction play intermediary roles, of comparable strength, in the pathway through which natural environments influence psychological states. This study validates these two pivotal intermediary links in the theoretical framework, offering empirical evidence for the intrinsic paths through which natural settings exert positive psychological impacts.

DISCUSSION

Discussion of Research Results

This study collected a sample data of 413 through a questionnaire survey. By fitting the model, it was validated that the influence of nature affinity on positive emotional experiences has multiple links. The scale has good reliability and validity. The fit analysis indicates that indicators such as GFI, AGFI, CFI, and RMSEA of the model met the good criteria, showing that the model matched the sample data well. The mediation effect analysis revealed that physiological cognitive effects and psychological needs satisfaction play almost equivalent mediating roles between the influence of the natural environment and individual mental health. The mediation effect estimates for both are 0.337 and 0.43 respectively, with no significant difference in the effect size. Both have a positive mediating effect on positive emotional experiences.

The results preliminarily verified the multi-link mechanism model of the influence of the natural environment on mental health constructed on a theoretical basis in this study, providing significant empirical support for the theoretical framework. By adopting a quantitative research paradigm and fitting a model to analyze quantitative data, the theoretical framework is empirically tested, which has a positive significance for promoting the development of this research field. This study confirmed the two key mediating mechanisms in the theoretical framework, contributing to a deeper understanding of the intrinsic process of the impact of the natural environment on psychology.

Comparison with Previous Research

Upon a systematic review of literature, past research predominantly stems from perspectives such as the Attention Restoration Theory and Stress Reduction Theory, focusing primarily on the direct effects of natural environments. In contrast, the present study posits a multi-link mechanism model grounded in theoretical foundations, incorporating various mechanisms including

psychological need satisfaction. This approach delineates the multifaceted processes through which natural environments influence individual psychology, thereby expanding the scope of previous studies. Specifically:

The Attention Restoration Theory accentuates cognitive functions while neglecting individual variances (Cassarino et al., 2019; Trammell & Aguilar, 2021). The novel framework of this research integrates the psychological need satisfaction from the Self-Determination Theory, elucidating how different individuals achieve psychological restoration by fulfilling diverse psychological needs. This addresses the shortcomings of the Attention Restoration Theory in overlooking individual differences.

The Stress Reduction Theory overly emphasizes physiological mechanisms (Herchet et al., 2022). The innovative framework introduced here incorporates the role of subjective cognition in stress alleviation, compensating for the Stress Reduction Theory's limitations in acknowledging cognitive factors.

The Biophilia Hypothesis offers limited exploration of individual differential effects (Bratman et al., 2019; Brymer et al., 2021). The proposed cyclical enhancement model in the new framework facilitates the examination of the distinct impacts of natural environments on different groups, rectifying the oversight of group variations in the Biophilia Hypothesis.

The Self-Determination Theory does not thoroughly consider the effects of varying natural environments (E. S. Lee et al., 2022; Yang et al., 2022). The new framework distinguishes between different types of natural settings, assessing their differential roles in satisfying psychological needs, thereby addressing the oversight of environmental variations in the Self-Determination Theory.

The Flow Theory places excessive emphasis on subjective experiences (Xie et al., 2022). The advanced framework in this research introduces objective physiological cognitive indicators to evaluate the tangible impacts of natural environments on individuals, countering the overly subjective orientation of the Flow Theory.

In summary, the newly proposed framework amalgamates the strengths of each theory, introduces novel mechanisms and indicators, differentiates between natural environments and individual variances, and systematically addresses the limitations of each theory, presenting a more comprehensive and enriched theoretical model.

Limitations of the Study

Firstly, this study adopted a cross-sectional research design, surveying the sample at a single time point, which makes it challenging to ascertain the chronological and causal relationships between research variables. External confounding variables could not be excluded. Future studies should adopt a prospective cohort design to confirm causative mechanisms.

Secondly, the sample was limited to the Shanghai area, presenting certain regional limitations. To enhance the generalizability of the results, future research needs to adopt a multi-center design, expanding the regional and demographic representation of the sample, or undertake international multi-center collaborative research to examine the cross-cultural applicability of the model.

Furthermore, this study primarily focused on validating the overall mechanism model. Future work can delve deeper into specific links in the model, such as the neural mechanisms of physiological cognition or which dimensions of psychological needs satisfaction play a major role, to clarify more detailed intrinsic processes. Individual differences can also be introduced to examine their moderating effects.

Lastly, this research only conducted a single questionnaire survey. Future endeavors should continue with larger sample studies, repeatedly validating the theoretical framework based on new data, continuously optimizing and revising the model, and establishing a continually improving cumulative big data platform.

Countermeasures and Outlook

In light of the study's limitations, future research should consider several approaches: Firstly, employing a prospective cohort design to track and record various indicators over time, enhancing the understanding of causative relationships. A randomized controlled trial could also be considered for more reliable causal inferences. Secondly, increasing the sample size and diversity through multi-center or international collaboration would improve the generalizability of the findings. This approach allows for subgroup analysis to explore the impact of individual differences. Thirdly, incorporating a broader range of indicators, including physiological measures like electrocardiograms and skin conductance, and potentially using fMRI to study brain activity in response to natural environments, can provide a more comprehensive understanding of the mechanisms involved. Fourthly, further specificity in research is needed to understand the distinct effects of various types of green spaces and the underlying psychological and physiological processes. Lastly, ongoing research with large samples and continuous model refinement based on new data is essential for the development of a robust and comprehensive theoretical framework.

Directions for Future Research

This study is a step towards a systematic framework on how the natural environment impacts mental health. Future research should adopt a prospective cohort design to track variables over time, enhancing understanding of their relationships. Expanding the sample size through multi-center or international

collaboration will improve generalizability. Incorporating a wider range of indicators, including physiological and neuroimaging techniques, is vital for understanding the environment's impact on brain activity. Distinguishing different types of natural environments and their effects is crucial. Longitudinal research can provide insights into developmental needs, aiding in tailored environmental planning. Practical applications of the theoretical model in areas like park design and therapy can validate and refine the theory. Continuous research with larger samples is essential for developing a comprehensive framework on the natural environment's role in mental health.

CONCLUSION

The primary aim of this research was to evaluate and synthesize extant theoretical models pertaining to the impact of the natural environment on mental health, identifying contributions, gaps, and potential enhancements, culminating in a novel, integrative cross-disciplinary theoretical framework. Through a critical literature review, this study established and assessed five predominant theoretical perspectives, substantiating the significant mediating role of physiological-cognitive effects and psychological needs fulfilment in the nexus between natural environments and individual psychology. The study depicted an advancement cycle, from environmental connection to internal psychological enhancement, providing a pivotal theoretical base for explicating the multifaceted mechanisms by which natural settings influence mental well-being. Despite its cross-sectional design and regional specificity to Shanghai, the study lays the foundation for future expansive research. Prospective studies are encouraged to employ longitudinal designs, enlarge sample sizes, integrate additional research metrics, and strive towards a comprehensive and empirical theoretical construct.

ETHICAL STATEMENT

In this study, all participants were fully informed about the nature and purpose of the research before it began, and their informed consent was obtained. The data collected in this study were anonymized to ensure the privacy of the participants. The research process strictly adhered to relevant ethical guidelines to ensure that the rights and privacy of the participants were respected and protected.

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