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Sustainable Solutions from Nature : Research Advancements and Application Prospects in China

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Abstract

This research aims to synthesize previous work on Nature-based Solutions, which have gained prominence in climate change and equitable development studies. Using China's National Knowledge Inventory and the WOSB, academic articles on NbS are screened to identify critical points, explore relationships between research pieces, and propose avenues for enhancing NbS in academic and industrial contexts. The study reveals a current focus on object-based schemes rather than subject or goal-based approaches, emphasizing the importance of indigenous resource applications within China's NbS development. The findings shed light on diverse domestic and international methods employed to investigate and implement Nature-based approaches, facilitating their localization in China.

Keywords *: climate change, equitable development, policy tools, ecosystem preservation, restoration initiatives, equitable development, sponge towns, water management*

Introduction

The World Bank's 2008 paper "Nature, Environmental Change Mitigation with Adaptation: Environment-Based Options in Sustainable Development Investing" defines natural resources as "a more systematic understanding of the relationship between mankind and nature," emphasizing ecosystem preservation, resilient economies, and addressing climate change impacts. NbS, according to the International Union for Conservation of Nature, refers to measures taken to preserve, sustainably operate and restore biological or artificial environments for human advancement and biodiversity. The International Union against Climate Change underscores the importance of NbS in combating global warming.

Over the past decade, NbS has been implemented in over 110 global investment initiatives, including mangrove regeneration in Vietnam and ecosystem maintenance in Colombo, Sri Lanka. NbS encompasses natural climatic approaches, ecosystem-based modification, ecosystem-based catastrophe prevention, and environmentally conscious buildings. It is crucial in mitigating serious socioeconomic concerns like global warming, natural disasters, poverty, water and food scarcity, emissions, habitat loss, and species disappearance.

Similar to the "natural idea" concept in China, NbS represents the evolution and integration of previous ideas such as green infrastructure, biodiversity, ecologic design and creation, ecosystem strategy, and related topics. While recent NbS research has primarily focused on developed regions like the United States and Europe, where significant experience and insights have been gained through initiatives like the National Biodiversity Strategy Roadmap and the European Union's Biodiversity

Strategy for 2030, ancient China also has a history of ecological preservation and restoration planning and design practices closely related to NbS.

By analyzing the development of NbS research and reviewing existing literature, the study aims to draw valuable lessons from both domestic and international experiences. Based on this foundation, the study seeks to advance NbS in China by promoting its unique application and operational framework tailored to its specific needs and context.

Methods of Inquiry and data collection

Data collection

The primary focus of this piece is NbS, which was explored through articles sourced from the International Journal of Research and the China National Knowledge Institute (CNKI) database. The poll conducted in October 2022 predominantly targeted publications from the previous decade. To ensure relevance to NbS, a 'search terms' approach was developed, involving a thorough review of manuscript titles, abstracts, and results. Based on the outcomes of a literature search, specific phrases such as NbS, environmental preservation and conservation, ecological system, global warming, ecosystems, and ecological funding were selected as keywords. The Internet Encyclopaedia of Science database yielded 324 journal articles on NbS, while the CNKI database provided 183 publications. The author excluded articles from early online magazines and other volumes that were not relevant to the study. As a result, 126 evaluation proposals and relevant literature papers were shortlisted for further investigation.

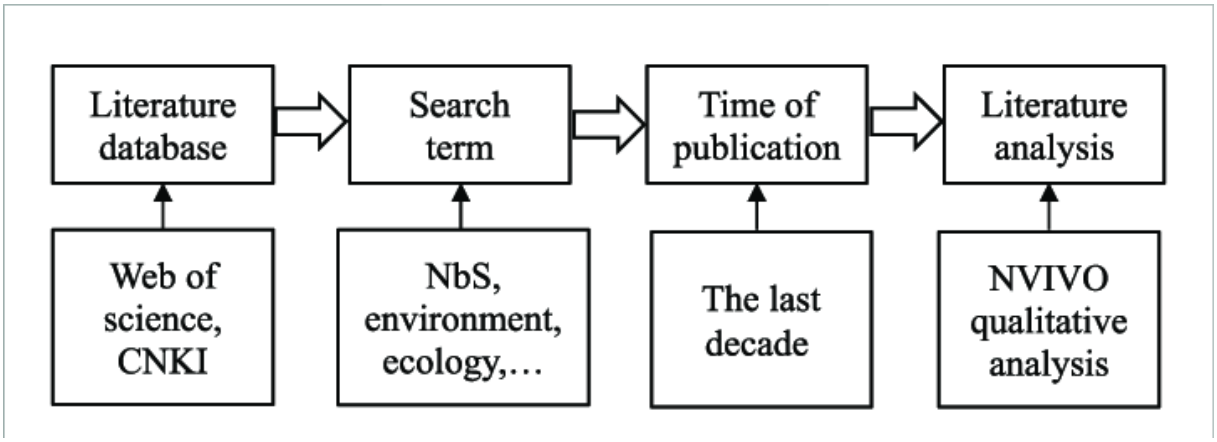


FIGURE 1 : Methodology for qualitative evaluation of data using Nvivo and NbS.

Research Methodology

The study primarily relies on exploratory methodologies to compile domestic and international research perspectives on NbS. The initial step involves skimming the textual information to understand its organization and content. Subsequently, the raw text input is encoded in Nvivo12 software, generating offspring nodes. Figure 1 depicts the refinement of an older node representing a younger node's research viewpoint of NbS. The gathered literature is categorized using NVIVO, Inc statistical software, focusing on perspective and keywords, with NbS as the central theme (Pan and Tang, 2020). Text analysis summarises and analyses the patterns and relationships between subjects or characteristics within the literature, capturing information relevant to the central research viewpoint for further analysis. The article keywords are classified into unsupervised (algorithm-based) and supervised (human-based) groups. Organizing words with similar meanings into categories, this

systematic approach uncovers hidden correlations and themes in the research writings, aiming to advance natural resources research. The study concludes by analyzing the research perspective and discussing the supporting scholarly works.

Critical elements of studies

NbS components used in implementing

The research on NbS implementation focuses on three main areas. Firstly, it emphasizes the connection between landscape features and ecologically-conscious architecture in cities like London and Philadelphia. Secondly, it advocates for ecological restoration methods that maintain natural order. Beijing's prototype restoration plan covers various endangered environments such as mountains, forests, rivers, agriculture, grasslands, and sand regions. Additionally, studies explore practical approaches for protecting and rehabilitating rivers, woodland, and urban and artistic ecosystems. Lastly, NbS addresses urbanization challenges, including water scarcity, pollution, ecological damage, and social welfare issues. Cities must tackle societal concerns like global warming, ecosystems, water safety, food availability, and socioeconomic progress. Forests, grasslands, farms, wetlands, oceans, and urban areas each have unique roles in mitigating rising temperatures. A multidisciplinary approach involving ecology, geography, administration, and more is necessary to achieve synergistic benefits.

NbS as a topic regarding implementation

Extensive research has focused on the role of humans and environmental factors in the spread of NbS. Studies have explored ecological protection and restoration methods while examining the delicate balance between ecosystems and human activities. The perspectives of both consumers and decision-makers have been discussed in implementation studies. The government typically takes responsibility for ecosystem repair after resource depletion. NbS encompasses various environments, including forests, grasslands, agriculture, wetlands, oceans, and urban areas. Policy tools for NbS, similar to traditional environmental policies, include regulatory measures, incentive programs, and voluntary participation. NbS plays a significant role in addressing climate change, biodiversity conservation, and political equilibrium. Beijing has taken substantial steps in global coordination efforts for climate change mitigation and biodiversity protection. Defining ecologically significant areas and implementing policies to preserve environmental security, such as the concept of an ecological red line, have set minimum standards. China has prioritized biodiversity protection and implemented large-scale ecosystem preservation and restoration initiatives through its national park system and nature reserve network.

NbS Objectives for Deployment

The main objectives of NbS are to prioritize ecosystem preservation, restoration, and the provision of services. Different strategies can be employed to restore river ecosystems. Global research has extensively explored the advantages and disadvantages of NbS and related services. The concept of nature's dedication to people recognizes the environment's fundamental, functional, and societal value, similar to ecosystem services. Recent studies highlight the crucial role of NbS in promoting long-term ecosystem health. NbS holds promise in addressing global concerns such as environmental degradation, biodiversity loss, human well-being, and climate change. It aligns with various Sustainable Development Goals, including poverty and hunger eradication, health improvement, access to clean water and sanitation, empowerment of marginalized communities, and environmental conservation. Ecologically responsible urban practices, like rooftop gardens, campus green spaces, and extensive city parks, reduce environmental stress and provide habitats for native flora and fauna.

Conclusions from the study

This study employs statistical methods to assess the progress of NbS research, examining its primary focuses, resource definition, and shifting research agenda. Key topics emerging from the analysis include environmental pollution, ecosystem conservation and restoration, sustainable cities, urban ethics, and equitable development. The findings indicate a growing academic interest in NbS across

various disciplines, with a steady increase in publications. Notable focus areas include sponge towns, water management, carbon neutrality, economy, and integrated water-NbS approaches. The shift in NbS studies is observed from philosophical inquiry towards applied work and policy development. However, the study highlights a need for both theoretical and practical knowledge of NbS implementation options, emphasizing the importance of region-specific research in China to address diverse challenges faced throughout the country.

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