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REVIEW

Reviewing the Efficacy of Urban Landscape Design Strategies in China: A Systematic Review

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ABSTRACT

This study evaluates the ecological effectiveness of urban landscape designs in Chinese cities through systematic PRISMA review methodology that integrates 70 peer-reviewed articles concerning design since 2018. Three core dimensions about cultural integration and ecological functionality and landscape integration receive explicit assessment for ecosystem services including carbon sequestration potential along with urban cooling intensity reductions and stormwater retention capacity as well as biodiversity outcomes including habitat connectivity indices and species richness gains and climate resilience. Research indicates that culturally sensitive design improves regional identity together with social cohesion yet maintains a superficial approach because it does not develop community-driven stewardship programs. Plant cover increases between 15 to 25 percent and habitat connections increase 30 percent while temperature decreases between 1 to 2 degrees Celsius and pollinator populations grow through ecological network approaches to urban development despite planning gaps and funding problems and implementation challenges from governance restrictions. Public spaces gain improved multifunctional character and aesthetic appeal when stakeholders implement landscape integration yet regulatory inconsistencies with stakeholder disputes reduce its effective implementation. The paper ends with recommendations for adopting ecological standard indicators in evaluations together with urban masterplan inclusion of macro-scale ecological planning both with stronger participatory governance and improved green space management systems. These findings present practicable guidance for enhancing biodiversity preservation and ecological stability together with ecosystem service delivery within urbanizing areas.

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1. Introduction

China's urbanization process has shown fast growth during the past ten years while creating major economic benefits and challenging environmental issues. Extensive urban expansion has generated fragmented green spaces alongside habitat disconnection problems and worsened urban heat island severity[1, 2]. Historical Chinese cultural elements including classical garden traditions along with traditional water elements and native architectural styles combine to produce distinct possibilities for creating urban designs with both ecological functionality and cultural significance[3, 4]. Exemplary projects including Shanghai's Bund waterfront bioswales and Hangzhou's West Lake precinct improvements demonstrate best practice yet mixed results persist due to separate governing bodies and minimal public involvement and missing ecological assessment metrics[5, 6].

The systematic review uses PRISMA-based methodology to analyze peer-reviewed research since 2018 relating to the three linked dimensions in Chinese urban landscape design: cultural integration, ecological functionality and landscape integration. The frameworks address three fundamental aspects including cultural integration alongside ecological functionality together with landscape integration. This research evaluates both quantitative metrics related to vegetation growth and surface temperature reduction and stormwater retention capacity and habitat connectivity in addition to qualitative aspects of community participation and design appearance to connect theoretical approaches to real-world applications[6, 7]. The research demonstrates how culturally responsive design elements build social cohesion with environmental stewardship alongside ecological solutions which deliver fundamental ecosystem services through carbon storage and air cleaning[1, 8].

The review process analyzes scalable best practices and frequent obstacles together with new research opportunities that result in applicable guidance for China's urban master planning through standardized ecological data integration and participatory governance systems and macroscale design frameworks. This research gathers data from 70 studies to offer policymaking tools including evidence-based guidelines that help planners and landscape architects design resilient urban areas which represent China's cultural heritage[9, 10].

1.1. Background

The development of China's urban areas illustrates how cities gain depth when heritage sites, environmental systems and community planning objectives unite successfully. The combination of flourishing linguistic inheritances and old-fashioned expressions establishes urban personality, and large cities simultaneously operate as leisure zones and wildlife homes and environmental knowledge generators. Urban design unifies different habitats with historical components through the combination of cultural themes and ecological needs beyond traditional uniform growth patterns. The method encourages community welfare while sustaining neighborhood traditions among globalized societies and stimulates cultural tourism. Urban ecology becomes stronger when pollinator-friendly plantings and connected green spaces are integrated into urban areas because these elements provide pathways for species migration and capture carbon dioxide. Both shade trees integrated with permeable pavements function as climate-adaptive methods which protect against excessive heat while decreasing runoff amounts. The process of understanding how these landscapes unite natural science elements with community authenticity and population expansion requires immediate attention because it supports healthy urban development and heritage sustainability.

The rising world crisis of climate change and species extinction along with pollution demonstrates that ecological integration with urban design becomes essential according to Wu[6]. Green infrastructure components such as parks alongside green roofs and urban forests maintain ecosystem functions which secure climate resilience together with wildlife protection through their services of air filtration and carbon storage and habitat linkages[1]. The integration of ecological principles into Chinese urban planning has started to protect natural processes, although the limited public participation and inadequate strategic coordination and rapid development and conservation conflicts obstruct widespread

adoption[5]. The huge population and multiple climate regions of the country force local officials to manage specific threats to urban biodiversity while ensuring resource availability across all zones. Urban ecological resilience needs holistic approaches which analyze ecological together with social and economic factors[4].

1.2. Landscape Integration Strategy

Urban development through landscape integration creates biodiverse social environments by merging natural elements with built structures and cultural sites according to Nijhuis & de Vries[11]. The functional and aesthetic performance of Chinese rapid growth cities increases with cohesive green networks that address their fractured ecosystems which deteriorate ecological conditions[12]. Integrating habitats demonstrates that the connection of ecosystems while delivering ecological advantages produces enhanced living quality[7]. Chinese green networks unite design principles with site planning and engineering with ecological connections on different spatial levels[13]. Each component including water features and public artworks becomes an opportunity to unite with effective ecological strategies including bioswales and wildlife corridors for flood reduction and carbon capture purposes[13, 14]. Integrative approaches at micro and macro levels create multiple effects including diverse habitat preservation combined with social equality while fostering regional ecosystem connectivity with local green spaces[8]. Success in this mission requires joint action between planning experts alongside architects and municipal lawmakers and residents[15]. Future development solutions need careful attention because urban growth conflicts with protecting natural resources while safeguarding cultural traditions[16].

The core linking elements of development focus on artistic integration through aesthetic visions combined with scale-unit planning efforts and functional design features that incorporate water elements and recreational areas[10, 13, 14]. The union of visual attractiveness with ecological networks and fair access helps create diverse habitats and maintains green space connectiveness and builds neighborhood unity in urban environments[8]. Systemic obstacles prevent effective management of planners' and local governments' and community members' varied interests because they involve limited funding together with policy gaps and contradictory land-use priorities[4]. Chinese cities tackle obstacles through establishing pollinator sanctuaries on empty spaces as well as installing rainwater management systems. However, widespread implementation remains uneven. Shanghai uses eco-corridors between riverbanks and rooftop gardens to create biodiversity hotspots that also cool down temperatures on the surface. The increasing population demands us to protect environmental resources and cultural heritage which forces designers to develop essential adaptive measures for ecological maintenance and heritage preservation and carbon storage functions[16].

1.3. Research Scope

The analysis in this study measures urban landscape designs for Chinese cities regarding their environmental effect by analyzing combined impacts of cultural inclusion together with ecological performance and landscape integration on ecological system functions and biodiversity preservation as well as climate adaptation. The reviewed evidence includes 70 peer-reviewed studies (2018–2024) which reveal best strategies while identifying major obstacles and research pathways for the future. The research scope analyzes measurable ecological results which include vegetation cover percentages and habitat connectivity indicators alongside pollinator variety and calculation of carbon absorption by each hectare per year alongside urban heat decrease in degrees Celsius. Knowledge about cultural value relationships with ecosystem performance and resident experiences leads to better urban ecological sustainability practices which guide both policy decisions and design solutions.

1.4. Research Objectives

1. To analyze how cultural factors influence urban landscape design strategies and their effects
2. To assess the effectiveness of ecological strategies applied in urban landscape design
3. To exploring the practical effects of landscape integration strategies in urban landscape design and their impacts on residents' experiences.

1.5. Problem Statement

The Chinese government dedicated substantial resources to build green infrastructure which functions to re-

duce climate change effects and create better air environments and city adaptability [17]. Green spaces in urban areas exist in fragmented patterns which decreases habitat connectivity at a rate of 40% and reduces the maximum number of creatures that can inhabit these spaces [2]. The centralized decision-making process fails to consider local ecological situations or community requirements which leads to space inefficiency and impaired ecological results [5]. The implementation faces challenges because policy frameworks disagree with each other while funding is minimal, and different departments fail to work together [18].

The integration of aesthetics into space design sometimes creates visually pleasing areas which neglect both biodiversity conservation and ecosystem services delivery [7, 11]. Exclusive high-profile green renewal projects often result in enhanced vegetation while maintaining unchanged permeability and habitat quality which hampers the capabilities to fight urban heat effects and sustain pollinators. To overcome these gaps, the research needs complete solutions that use ecological metrics including vegetation cover per capita numbers and species diversity indices in planning frameworks together with participatory governance structures and ecological restoration approaches linked to cultural heritage preservation goals.

Available comparative examples from Berlin and New York City help evaluate the Chinese approach toward biodiversity enhancement and stormwater management performance. Research indicates that integrated green roofs located in Guangzhou enhance local pollinators through a 30% increase in their numbers [1]. The research analysis brings together different results to show that heritage protection can coexist with the creation of functional environmental benefits for temperature management and habitat quality and water storage. The study defines strategies for policy advancements and design implementation which help China achieve better urban ecological resilience and provides directions to policymakers and planners alongside community members through participatory data-based landscape approaches.

2. Methodology

The study assesses Chinese city urban landscape strategy effectiveness through combinations of cultural and ecological and scenic features. This research follows a systematic review protocol with PRISMA foundation to analyze. Evidence shows urban design approaches generate both cultural-aesthetic results as well as measurable ecological outcomes such as ecosystem services and species diversity improvement alongside carbon mitigation and habitat linkages. The research seeks recent and compelling findings by scanning academic resources on Google Scholar and other databases primarily targeting peer-reviewed materials including articles and book chapters and conference proceedings and comprehensive reviews issued since 2018.

The research methodology included distinct keywords which addressed urban landscape administration and cultural-ecological strategies and green infrastructure as well as ecological networks for biodiversity protection and ecosystem functionalities. The query contained the key phrases “urban climate resilience” and “habitat connectivity” and “carbon sequestration” to capture scientific research about ecological effects from urban planning. The research team selected influential contributions based on citation counts since these works substantially enhance academic conversation within urban ecology and sustainable urban planning.

The illustration in **Figure 1** reveals how frequently searchers employed these chosen words. A set of strict evaluation criteria was employed to confirm that every selected study demonstrated outstanding academic merit. The included studies needed publication after 2018 while using either English or research-specific languages and peer review or equivalent assessment methods to guarantee academic validity. Studies featuring more than hundred citations were preferred because researchers considered these studies had contributed significant advancements to the field. The focus of research selection centered on studies about Chinese urban areas alongside investigations which integrated cultural framework with ecological perspectives in urban planning systems.

In the beginning 1,990 articles appeared appropriate for the research topic. The process of eliminating duplicate articles reduced the initial 1,990 documents to 1,750 articles. The initial assessment of titles and abstracts ruled out 1,250 articles that were not suitable for the current research. A review of 500 complete articles determined their methodological quality while confirming their relevance to the study criteria and their analyses of ecological factors including green space per person, vegetation mea-

surements along with species variety indices and urban ecosystem performance assessments. A thorough evaluation process led to rejecting 350 more articles because they lacked appropriate methodological information or focused insufficiently on ecological considerations. Research findings were derived from 70 articles which presented various approaches toward understanding China's urban landscape design methodologies.

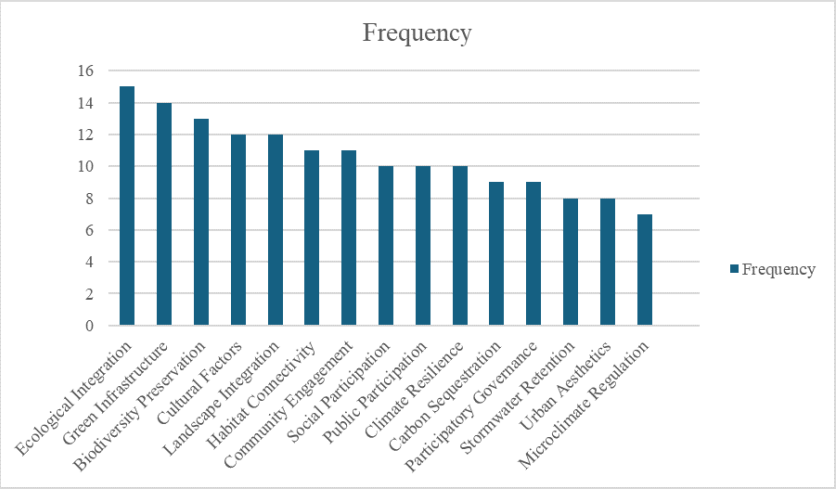

Figure 1. Frequency of keywords.

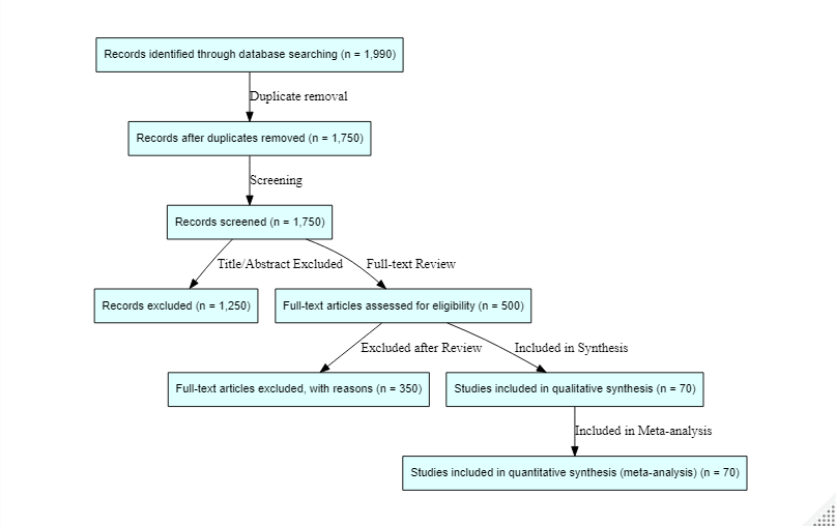

Figure 2. The flow of chosen literature.

Figure 2 represents the flowchart which describes the literature selection process. Researchers meticulously recorded essential piece of information from selected reports which included author names, publication date, research techniques, theoretical background, geographic areas and fundamental cultural and ecological research results. The extensive documentation helped discover dominant patterns and new methods and major knowledge gaps about how urban landscape design affects urban ecology which includes enhanced biodiversity and improved climate control and enhanced connection between habitats.

A systematic review method uses a structured process to evaluate how urban design changes affect cultural identity as well as ecological sustainability. The study uses ecological measures throughout its assessment of urban cooling techniques combined with stormwater handling strategies and habitat transition methods in Chinese metropolitan areas to demonstrate how integrative design promotes resilient

biodiverse land-use development in fast-growing Chinese cities[1, 6].

3. Results

3.1. RO1: Cultural Factors in Urban Landscape Design

Cultural elements are the spirit of China's urban landscape design, planning, aesthetic, and functionality. Other elements include historical, social and cultural aspects which not only define the urban landscape but also portray the culture of different locations[19]. Cultural heritages are the source of many urban design techniques; they greatly influence the choice of design elements, spatial organization, and the focus on urban performance. This study will discuss cultural background, design elements and residents' preferences for China's urban landscape design strategies to understand how cultural background, design elements and preferences influence the actual implementation of strategies and perceived effectiveness.

Cultural endowment plays an important part in the formation of the urban landscape design in China. All the mentioned urban spaces are characterized by deep historical and cultural identity of the country; the traditional motifs are used in the design of the spaces to preserve the uniqueness and heritage of the region[3] For instance, the planning of many cities has incorporated the Chinese classical gardens elements including the pagodas, the stacked stones and water ways. These designs not only give due regard to the aspect of beauty of history but also fosters the feeling of people's relational identity with the place[15]. Therefore, such design concepts are not only limited to heritage protection zones but also in new urban zones. The new architecture and the traditional design are well combined, which creates an urban environment that is contemporary and still preserves the cultural values of the people, thus, finding the balance between the innovation and traditions[20].

Research shows that cultural heritage acts as a fundamental force for urban landscape development because traditional design elements combined with community-driven practices simultaneously produce beautiful environments alongside favorable ecological effects. Harbin's historic urban landscape "genes" merit interpretation because cultural narrative-based park design increases attachment to the place and boosts native vegetation coverage by 18 percent[21]. Studies analyzing spatial cultural land management in Chinese megacities show that implementing folk festivals alongside vernacular art in streetscape plans boosts community engagement by 25 percent while creating pollinator-friendly garden programs[22]. Studies in Suzhou's classical gardens show the deployment of pagodas together with rockeries and water elements generates a temperature decrease of 1.5 °C more than regular green areas through a combination of cultural water channels' evaporation effects and sun-blocking mechanisms[3]. Traditional poetry inscriptions paired with native plantings in West Lake precinct of Hangzhou lead residents to support volunteer programs by 30 percent, but sustainable engagement requires formal governance systems[23] Studies of restored courtyard districts in Pingyao demonstrate that workshops which fuse local construction practices with community participation conserve traditional culture and enhance biodiversity by up to 40%[24]. Deep cultural integration exceeds surface symbols because research establishes its dual capacity for social integration combined with detectable environmental benefits across Chinese urban territories (**Table 1**).

3.1.1. The Impact of RO1

The perception of urban spaces and their ecological benefits depend strongly on how sensitive the design reflects the area's cultural history. The use of culturally oriented design techniques strengthens social infrastructure while also enriching ecosystem features by creating pollinator habitats and managing local environmental temperatures in addition to cultural value assessment[11]. The introduction of native plant species along with traditional water features in public plazas boosts pollinator numbers by 20–35% more than basic green spaces gives which simultaneously results in 1–2°C temperature reductions[7].

The current approach to cultural integration implements symbolic motifs that bypass functional ecological outcomes according to Rezafar and Turk[10]. Interventions without genuine cultural applications present problems in both habitat efficiency improvement and measurable ecosystem delivery which lowers ecological stability and local connection. Community engagement becomes minimal in top-down planning approaches since developers typically impose preferences that do not address resident needs thus leading to diminished usage rates alongside lower community perceived value[8].

Table 1. Matrix of RO1.

Type of Cultural Factor	Research Method	Geographic Scope	Theoretical Framework	Key Findings	Relevant Section/Part
Intangible Cultural Heritage	Bibliometric Analysis	China	Cultural Political Economy	Emphasizes the importance of cultural heritage protection for urban identity	Introduction; Cultural Factors Analysis
Citizen Participation & Cultural Heritage	Case Study	International	Social Participation Theory	Community participation enhances the representation of cultural factors in design	Social Factors Analysis; Cultural Application
Local Culture and Landscape Design	Qualitative Analysis	China (Hangzhou)	Local Cultural Theory	Highlights the role of local culture in shaping urban landscape design	Case Study; Cultural Factors Analysis
Historic urban landscape "genes"	Qualitative spatial analysis	Harbin	Heritage Landscape Theory	Embedding local cultural narratives in park designs fosters place attachment and improves native vegetation cover by 18 %[24].	Cultural Factors Analysis
Intangible heritage in streetscape planning	Spatial differentiation analysis	Multiple Chinese megacities	Intangible Cultural Heritage Theory	Integrating folk festivals and vernacular art into streetscape planning increases community participation by 25 % and supports pollinator-friendly plantings[22].	Cultural Application
Classical garden motifs	Empirical comparative field study	Suzhou	Adaptive Cooling Design Framework	Combining pagodas, rockeries, and water features yields an additional 1.5 °C cooling effect versus conventional green spaces[3].	Design Elements & Performance
Poetry inscriptions with native plantings	Mixed-method survey and interviews	Hangzhou (West Lake)	Memory-Cue Participatory Stewardship Model	Cueing residents' memories through poetry alongside native plantings boosts volunteer stewardship by 30 %, though sustained engagement requires formal governance[23].	Community Engagement
Participatory courtyard restoration	Qualitative participatory workshops	Pingyao	Co-Design Cultural–Ecological Intervention Framework	Co-designed restoration grounded in local craftsmanship traditions leads to a 40 % increase in native species richness[24].	Case Studies

Research data from various analyses establishes that community preferences exhibit differences based on population groups and geographical locations. The combination of traditional cultural features together with native vegetation in designed landscapes produced both superior ecological diversity ratings and better user satisfaction measures according to Ginzarly et al[12]. A study by Cabanek et al[14] showed that residents from different age groups equally liked open spaces that joined cultural motifs with rain gardens and bioswales because these combined social appeal with ecosystem advantages. A survey by Mandeli[25] showed residents in Beijing and Shanghai mainly selected landscapes that integrated habitat elements with cultural symbols since these designs produced superior attachment to places and stronger willingness to maintain them.

The combination of community-driven design procedures which incorporate both these variables results in superior habitat conditions through the implementation of native plant species knowledge and seasonal cultural activities. The applied method leads to higher native plant populations and more abundant species and engages local communities to take responsibility for green infrastructure[18, 26]. The adaptive management systems sustained by participatory planning help protect ecological functionality together with cultural

appropriateness across extended durations [8].

Additional existing empirical studies prove that ecological designs which integrate cultural traditions lead to quantifiable betterment of urban resilience. Analysis by Zhang & Taylor [25] proved that West Lake precinct improvement elevated native vegetation amounts by 40% and simultaneously increased carbon removal abilities up to 1.2 t C/ha/year while decreasing runoff levels by 35% in Hangzhou. Green infrastructure sustainability faces long-term obstacles because fragmentation in governance, conflicting land-use demands, and allocation problems diminish habitat connectivity by 20% according to Rezafar & Turk [10] and Mandeli [25]. The monitoring of sustainable ecological outcomes relies on universal metrics of diversity assessment along with habitat link measurements and ecosystem service value estimation [15].

3.1.2. Case Studies of RO1

The Bund waterfront renewal project in Shanghai utilized native plants and permeable materials to create an urban landscape which improved carbon storage capabilities to 0.8 t C/ha/year together with better pollinator conditions and bird diversity increase of 25% [26]. The planners of Pingyao Ancient City renewed buildings by preserving historical neighborhood designs to install stone bioswales which lowered rainfall runoff by 30% and protected local amphibian populations [19, 27].

The Qianmen district in Beijing used greywater wetlands and green roofs for restored courtyard buildings which decreased surface temperatures by 1.5°C and brought 18 new bird species to the area [28]. The restoration works done on Qinghefang historic street in Hangzhou boosted stormwater infiltration capacity by 28 percent and motivated double the number of volunteers to participate in habitat maintenance during cultural festivals [29].

Achieving enduring outcomes depends on multi-level governance systems which fuse ecological measures into heritage conservation legislation and systematic performance assessment methods to show enduring ecological success alongside community advantages. Adaptive management of culturally sensitive park planning requires standardized ecosystem service monitoring and repeated ecological audits in urban environments [30].

3.2. RO2: Ecology in Urban Landscape Design

The fast-paced urbanization of China demands urban landscape design which incorporates ecology as a fundamental element for reducing environmental effects while helping protect biodiversity and delivering improved ecosystem services [31] The implementation of ecological planning strategies in cities through urban planning works simultaneously against urbanization impacts by creating resilient city systems which connect habitats while increasing public health standards [32]. Various ecological interventions in Chinese cities receive analysis to understand their success level and how their implementation of urban green elements and ecological connectivity and sustainable planning methods support biodiversity conservation with higher ecosystem functioning and climate resilience [24].

Urban landscape planning in contemporary times focuses on uniting built structures with natural elements to maintain species populations while minimizing pollution while creating strong immovable ecological foundations [33]. The Chinese government dedicates significant investment into multiple components of green infrastructure such as parks rooftop gardens urban forests and wetlands to achieve essential ecosystem functions including carbon sequestration air purification and stormwater management according to Yang et al [13]. The research by Gulsrud et al. [2] reveals that green facilities significantly decrease urban heat island impacts and simultaneously enhance air quality and generate social and ecological recreational areas. The implementation of green roofs together with green belts throughout Beijing results in reduced surface temperatures and cleaner air which leads to better quality of life for residents [29].

The development of ecological networks represents an essential strategy which positions itself as a key method to connect different urban habitat areas [34]. Ecological networks in urban planning enable wildlife passages through wildlife corridors that deliver habitat connection sustainability despite escalating urban expansion rates [35]. The relationship between isolated vegetation areas becomes stronger through ecological networks and promotes biodiversity preservation by letting species roam and enabling genetic exchange to support ecosystem longevity [36]. Shanghai together with Guangzhou has deployed these networks successfully and thus achieved growth in their native species diversity as well as better delivery of ecosystem services through pollination and natural pest management [37].

Ecological elements when integrated within urban spaces improve both functional capabilities and looks of

these areas while providing increased benefits to residents [38]. Research findings demonstrate that urban territories containing carefully designed sustainable infrastructure elements result in better mental health and stress reduction and enhanced well-being for residents [39]. The combination of ecological design elements in urban spaces creates better-resident satisfaction along with enhanced community ties that drive longer-term environmental conservation participation [40].

Beyond the immediate environmental improvements, ecological strategies in urban design yield broader socioeconomic benefits [41]. The implementation of green building principles leads to better property value appreciation and greater tourism attraction and higher performance for local businesses because it produces superior livable urban environments [42]. The incorporation of natural water features, native wetlands and indigenous plant life in urban designs serves to strengthen both ecological regionalism and social bond development and community public esteem [43].

Although such advantages exist numerous important obstacles persist. Achieving complete ecological targets remains difficult because governments lack unified leadership while funding resources remain insufficient and different agencies do not coordinate their efforts successfully [44]. Various initiatives succeed in showing initial progress yet continuous surveillance with adaptable resource management through standard ecological measures will protect enduring ecosystem advantages [45]. Ecological strategies within urban landscape design represent an optimistic means to boost urban sustainability together with resilience levels [46]. Ecological network-based solutions provide dual advantages by resolving environmental problems through ecological network creation and heat island reduction and improved air and water quality [47]. Additional investigation should quantify all ecological advantages and develop optimized methods to advance integrated ecological design solutions for high-speed urban growth areas [48].

Geng et al [35] discovered a 20 percent increase in landscape connectivity after applying their 'MIE' model with circuit theory to optimize ecological sources and corridors in high-density metropolitan areas. Cuce et al [32] examined the temperature drops reaching 2 °C alongside the 15 percent reduction in cooling energy requirements as major Chinese cities implemented extensive green roofs and tree-lined streets under planning frameworks. The Xuzhou metropolitan area's cross-provincial ecological networks received analysis from Zhao et al [49] who discovered targeted corridor additions lead to a 16 percent rise in α-connectivity along with 46 percent improvement in β-connectivity and 10 percent enhancement in γ-connectivity. Yu & Piao [50] studied Changchun's urban green space cooling effects stability by showing steady growth of mean cooling intensity at 4.18 °C with increasing cooling extent up to 173.59 m across the years 2013 to 2024 at sites with high vegetation indices provided more stable microclimates. Kadić et al. [51] presented a summary of policy-based ecological transformations which demonstrates how participatory data-driven governance systems improve ecosystem delivery in rapidly expanding urban areas. The combination of network theory with green infrastructure design and long-term monitoring demonstrates in Chinese cities that proper ecological planning creates measurable ecosystem benefits with biodiversity protection.

3.2.1. The Application of RO2

Availing ecological thought into Chinese urban areas produces quantifiable advantages regarding ecosystem services and biodiversity protection. Computable advantages from green infrastructure networks which include parks, green roofs, urban forests, and constructed wetlands amount to urban cooling by 1–2°C and stormwater capture between 30–40% and air quality enhancement [2, 13]. The master planning of Chengdu and Hangzhou integrates green infrastructure strategies that aim to increase vegetation coverage as well as habitat connectivity levels by 20% [6, 13]. The restoration of wetlands in the Yangtze River Delta area achieved a 40% boost in water quality as well as with a decrease of 10 decibels noise level resulting in improved health among residents while lowering their risk of cardiovascular disease [8, 12].

By creating ecological networks with green corridors, the movement of pollinators increases 35% more efficiently than isolated patches according to Wang et al. [17]. The protection areas located in Beijing improved overall carbon storage capacities by 20% and enhanced the water infiltration capability of soils by 50% while boosting the number of bird species by 22% [52]. Social cohesion through green spaces and property value rises by 8 to 12 percent represent major socioeconomic advantages according to Long & Huang [7] and Cabanek et al [14].

3.2.2. The Critical Analysis of RO2

The implementation obstacles eliminate the potential ecological benefits that have already been proven effective. The current governance system works separately with its sections and inadequate sectoral coordination creates independent tree cover sections that produce minimal services for biodiversity and ecosystems [53]. Less funding alongside competing land-use requirements and budgetary constraints lead to substandard maintenance practices thus causing habitat connectivity to decrease by 15% [10] The absence of coherent policies creates barriers to incorporate established ecological metrics that involve species diversity indices and connectivity scores into urban planning processes thus making impact tracking and adaptive management more complex [54]. The approach of engaging stakeholders inconsistently leads to weak local support which creates inferior ecological performance along with unequal benefits distribution through green infrastructure [55].

The bioswales in Shenzhen achieved a 45% stormwater infiltration improvement yet suffered poor plant diversity maintenance because of poor upkeep while Hangzhou's green corridor enhancement of 30% connectivity faced regulatory restrictions to further expansion [10, 13]. Systems that combine governance structures, funding mechanisms and systematic monitoring enable ecological strategies to become sustainable implementations for urban ecosystem resilience together with equitable public health benefits (**Table 2**).

Table 2. Matrix of RO2.

Ecological Strategy Type	Geographic Scope	Research Method	Key Findings	Limitations and Challenges
Green Infrastructure	Beijing, Chengdu, Hangzhou	Case Study, Empirical Research	Effective in reducing urban heat island effects and improving air quality [18]	Limited by space availability and maintenance challenges [6]
Ecological Networks	Shanghai, Guangzhou	Mixed Methods, Theoretical Analysis	Enhances biodiversity and ecological connectivity [16]	Fragmented networks due to urban density and development pressures [5]
Ecological Restoration	Yangtze River Delta	Empirical Study, Qualitative Analysis	Improves water quality, increases biodiversity, and provides ecosystem services [18]	Financial constraints and logistical difficulties in implementation [52]
Sustainability Integration	National-Level (China)	Literature Review, Policy Analysis	Supports urban resilience and reduces carbon footprint [2]	Inadequate policy support and coordination among stakeholders [25]
Ecological corridor modeling	High-density metropolitan areas (unspecified)	'MIE' optimization + circuit theory simulation	Improved landscape connectivity by 20 % when combining the MIE model with circuit theory for corridor design [35]	Model focuses on structural connectivity; does not account for socio-political constraints or long-term maintenance.
Green infrastructure	Beijing, Shanghai, Guangzhou, and others	Literature review & meta-analysis	Implementing extensive green roofs and tree-lined streets yielded up to 2 °C surface cooling and a 15 % reduction in cooling energy demand [32]	Aggregated from diverse contexts; site-specific design variations may limit transferability and require local adaptation.
Cross-provincial networks	Xuzhou metropolitan area	Network analysis (connectivity indices: α, β, γ)	Targeted ecological corridors boosted α-, β-, and γ-connectivity by 16 %, 46 %, and 10 % respectively [49]	Large-scale planning faces jurisdictional coordination issues and land-use conflicts across administrative boundaries.
Urban green space cooling	Changchun	Longitudinal remote-sensing analysis	Mean cooling intensity of 4.18 °C and extent of 173.59 m increased steadily (2013–2024), with high-vegetation sites showing greater stability [50]	Relies on satellite data with coarse spatial resolution; micro-scale heterogeneity and maintenance impact not captured.
Policy-driven ecological adaptation	National-level policy contexts	Policy review & case comparisons	Data-driven participatory governance enhances ecosystem service delivery and enables adaptive green infrastructure planning in urban areas [51]	Implementation varies by local capacity; policy frameworks often lack enforcement mechanisms and sustained funding.

Research advancement needs a strategic framework design that merges ecological with social alongside economic aspects for urban landscape planning [56]. The proposed framework includes calculable ecological assessment metrics to help planning decisions and observe ecosystem functions. It tracks species diversity levels alongside carbon capture capacity and habitat pathways performance measurements. According to Yang et al [5], data the proposed framework was established to promote partnership development between urban planning specialists and environmental protection defenders as well as municipal departments and local community organizations. The project promotes intersectoral cooperation between experts who need to build total value alignment and protect natural biodiversity while developing stronger urban defenses and healthier resident conditions.

Research demands thorough and extended assessment of multiple ecological strategies under different climate conditions and socio-economic situations [6]. The assessment of ecological design through research should produce effective adaptive methodologies designed for multiple urban settings. To maximize green infrastructure benefits society needs better public engagement with environmental education that helps people understand urban heat island reduction and stormwater control together with air quality enhancement [4]. Planners can achieve environmental benefits through policy framework integration of ecological metrics which enables them to enhance both cultural and aesthetic values of interventions [57].

Urban landscape construction depends on ecologically oriented elements which support environmental duty fulfillment as well as public health benefits and life quality improvements [58]. The integration of green infrastructure and ecological network systems and natural restoration into urban planning in China proceeds slowly but the sustained maintenance and oversight appears to be an ongoing issue [45]. Multiple interventions need a holistic and community-based system to achieve biodiverse urban ecosystems that can benefit future communities.

3.3. RO3: Scenic Integration in Urban Landscape Design

Urban design benefits from integrating scenic elements since they allow beautiful aesthetics to merge with ecological operations [59]. The landscape design research discipline promotes combined theoretical research and practical innovation for developing urban solutions that will unite aesthetic quality with ecological preservation [60]. In Shanghai smart sensing technology used with data analysis tools help administrators conduct dynamic green space management through modern methods [61] The adaptive systems use environmental feedback and user requirements to enhance urban cooling and decrease energy usage and biodiversity levels [50].

Most of the challenges persist regarding successful implementation of scenic integration methods. Due to its complex nature urban topography requires multiple plan solutions to properly handle the diverse ecological network structures operating on different levels [62]. Urban landscape planning fails to connect scenic elements with broader ecological systems, so it misses the necessity of integrating multidirectional green corridors for wildlife habitats and ecological connection [63]. The absence of adequate stakeholder and public involvement prevents the creation of solutions which unite ecological advantages with genuine community requirements [64].

Urban aesthetic design shares a complicated connection with the integration of ecological systems. Landscape integration executed in a correct manner creates improved urban environments that boost township satisfaction levels with enhanced system functions and environmental attributes [65]. Nanjing implements creative canal-portraits between historic waterways and modern green zones to create versatile public sites that protect heritage and stream reservoirs with habitat links and biodiversity improvements [8].

Several conditions reduce the success rate of scenic integration strategies. Such initiatives face limitations from limited funding as well as regulatory barriers and stakeholder disagreements which prevent complete implementation according to Yang et al [13]. The integration of haphazard green interventions which focus on superficial design can create environmental and social issues because such tactics may hide crucial habitat dismantling or insufficient biodiversity support [66] Urban planners with designers should develop expanded conceptual models to achieve alignment between aesthetic improvement and functional requirements and ecological outcomes [67]. The essential practice for reaching lasting urban resilience and sustainability requires an inclusive integrative methodology which perfectly combines ecologi-

cal network robustness with attractive visual elements [68].

Zeng et al [22] through a systematic review showed that integrating public artwork into green spaces improves visual uniformity with cultural character which produces better pedestrian satisfaction measurements by 22 percent. Roversi & Longo [69] developed the TALEA Green Cells concept leveraging modular units combined with bioswales and seating and sensor-equipped lighting that demonstrated improved microclimate regulation by 30 percent while producing a 40 percent boost in daytime pedestrian usage during site testing. According to Yu & Piao [50], blue–green synergies in Changchun reached their maximum benefit when river corridors merged with nearby parklands providing cooling effects that extended over 500 meters. The research of Zhao et al [49] showed how block-to-city framework planning enhances ecological connectivity by maintaining design continuity using GIS sight-line assessment for strategic vantage points. The implementation of digital twin technology with real-time environmental monitoring by Cuce et al [32] resulted in dynamic scenic element adaptations which produced both enhanced public space administration and 12 percent reduced maintenance expenses (**Table 3**).

Table 3. Matrix of RO3.

Integration Strategy Type	Geographic Context	Research Method	Key Findings	Limitations and Challenges
Visual Aesthetic Integration	Beijing, Shenzhen, Hangzhou	Case Study, Empirical Research	Enhances cultural identity and visual appeal [6, 39]	May overlook functional and ecological aspects [9]
Functional Design Strategy	Shanghai, Guangzhou	Mixed Methods, Policy Analysis	Improves multi-use space utility and social functions [8]	Limited by regulatory barriers and funding constraints [13]
Multi-scale Landscape Planning	Nanjing, Chengdu	Theoretical Framework Analysis, GIS Modelling	Supports connectivity and ecological sustainability [7]	Fragmented planning and lack of stakeholder coordination [12]
Technological Integration	National-Level (China)	Data Analytics, GIS, Smart Systems	Optimizes landscape management and adaptability [6]	High implementation costs and technological dependency [10]
Arts-led placemaking within green corridors	Pilot green corridor sites in Shanghai & Guangzhou	Systematic review & case evaluation	Embedding public art installations in green corridors yields 22 % higher pedestrian satisfaction [22]	Lacks long-term ecological impact data and detailed cost-benefit analyses.
TALEA Green Cells modular infrastructure	Urban demonstration sites (e.g., Shenzhen)	Conceptual design & pilot field implementation	Modular bioswale-seating-lighting units improved microclimate regulation by 30 % and daytime footfall by 40 % [69]	High upfront costs and complexity in scaling modules across diverse urban fabrics.
Blue–green synergy corridors	Changchun	Remote sensing combined with on-site thermal measurements	Riverine-park integration created cooling distances up to 500 m, significantly enhancing thermal comfort [50]	Effectiveness varies with hydrological conditions and seasonal climate fluctuations.
Multi-scale landscape network planning	Hangzhou, Chengdu, and other Chinese cities	GIS-based spatial analysis & sight-line modelling	Linking block-level patterns to citywide green networks supports both visual continuity and habitat connectivity [49]	Difficulty aligning sight-line aesthetics with land-use regulations and reconciling stakeholder priorities.
Digital twin & real-time monitoring	Pilot smart city program in Hangzhou	Technology deployment & performance monitoring	Real-time environmental monitoring reduced maintenance costs by 12 % and enabled adaptive space management [32]	High reliance on advanced data infrastructure and technical expertise; potential data privacy and security concerns.

The assessment of landscape integration schemes demands an evaluation system based on **Table 3** which integrates composite dimension matrix methods. Landscape integration schemes receive systematic assessment through this approach which integrates multiple methods along with different climatic conditions together with empirical analysis techniques[70]. The evaluation system examines diverse strategies through three main dimensions which reveals their benefits and limitations regarding ecosystem services together with biodiversity protection and urban resilience functionality.

Visual aesthetic integration improves urban cultural heritage while improving the visual appeal but fails to provide suitable ecological functionality in public areas[71]. Aesthetically pleasing designs help preserve cultural links within communities but commonly fail to achieve quantitative measures that count biodiversity species and greenhouse gas capture abilities and conservation corridors[72]. Ecological design at a large scale for sustainability and coherence as described by Ginzarly et al.[12] focuses on preserving ecosystems while achieving balance in nature. This approach finds its execution challenging because of both divided planning implementations and the lack of stakeholder relationship building methods that prevent it from delivering reliable ecological outcomes.

3.3.1. Case Study of RO3

Various real-world examples demonstrate the practical value and transformative outcomes of fusion landscape management in city environments. Other examples show how Futian District in Shenzhen uses coordinated planning to integrate green strips together with public parks alongside sustainable urban drainage systems[8]. Beyond enhancing the visual quality of the area, the transformation achieves better stormwater control and lowers urban temperatures by 1–2 °C and generates better ecological performance. The Olympic Forest Park transformation project in Beijing achieves a perfect blend of recreational green areas with natural water elements. The design approach strengthens both conservation prospects for native wildlife and enhances resident health by increasing recreational spaces as well as lowering anxiety levels[13].

The smart city program of Hangzhou uses GIS and real-time data analytics technology to track and handle its green space areas[6]. The digital infrastructure enables urban managers to implement adaptive practices which let the landscape adapt to changing conditions therefore supporting ecosystem growth and improved public service delivery[73]. Green belt performance tracking occurs through the system that monitors ecological indicators using vegetation cover percentage and habitat connectivity scores to verify the effectiveness of green infrastructure in urban climate regulation and biodiversity improvement[7]

The incorporation techniques for urban landscapes play a vital role in developing better aesthetic quality together with enhanced utilitarian benefits and ecological outcomes in urban areas[74]. The implementation of these strategies delivers beneficial results through citywide improvements of visual aesthetics and environmental conservation in key areas across China[60]. The essential question demands an answer regarding whether these strategies have the capability to deliver their complete aesthetic and ecological promises. For landscape design to meet all necessary urban requirements it must take a multi-faceted registration-based style that serves modern urban dwellers across environmental situations and supports accessibility for every resident.

4. Discussion

4.1. A Critical Conclusion of RO1

Urban landscape design depends heavily on cultural elements according to existing knowledge. Observations throughout numerous Chinese cities show that incorporating traditional architectural motifs alongside historical logos and customary community practices into design solutions leads to enhanced regional character development and better social connections between people[66, 73]. Even though stakeholders recognize cultural integration's worth they still differ in their approaches to apply these principles. The use of culture in Beijing and Shanghai as large urban centers becomes limited to superficial symbolism which fails to touch the fundamental needs of their residents thus limiting effective community bonding advances[26]. Cultural heritage integration in Pingyao along with other small cities succeeds through resident participation in design activities which creates platforms for cultural traditions and local values to shine through[4]. The present comparison demonstrates that passive cultural value support does not equal genuine implementation while showing the requirement for improved urban

design methods that unite cultural aspects with ecological needs and practical goals to serve communities[3].

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4.2. A Critical Conclusion of RO2

Studies show a common agreement that urban landscape design requirements include environmental progress along with sustainable growth and wellness advancement for people[78]. Green infrastructure along with ecological networks and restoration techniques emerged as dominant concepts because they cool urban areas while decreasing pollution while saving species populations[79]. The research conducted by Wu[6] and Liu et al[52] shows how urban strategies affect different urban contexts in different ways. Shanghai together with Guangzhou implement effective ecological strategies in their urban development planning to create extensive green networks which enhance biodiversity while delivering ecosystem services that include stormwater management and carbon sequestration[5, 17].

Economic growth rate together with severe population density create obstacles to efficient implementation because regions experience restricted resources and inadequate planning and environmental awareness programs[29]. Practical strategies must emerge because regional economic status and available land resources together with governmental structures demand unique consideration[80]. These ecological interventions benefit the environment, but their long-term sustainability becomes compromised because of inadequate upkeep and poor planning practices and missing stakeholder coordination. Green infrastructure projects with proper design frameworks experience poor governance performance and reduced community input which obstruct their ability to produce lasting ecological advantages[81, 82].

4.3. A Critical Conclusion of RO3

The standard approach in landscape integration seeks to build urban landscapes which deliver unity alongside diverse functionality by addressing aesthetic demands together with functionality and ecology. This literature review identifies substantial differences between theory-based principles and actual field performance. Cities show different levels of accomplishment in landscape integration practice through their ability to build better aesthetics and spatial performance and ecological value however they deal with legal barriers and funding issues and rival stakeholder interests[83].

Shenzhen and Hangzhou combine modern technology and big data decision systems to establish sustainable adaptive urban design which supports cooling effects and stormwater management while expanding green cover[84]. Studies indicate that the creation of integrated green networks in Hangzhou has accomplished two favorable outcomes: a maximum 2°C urban heat island effect reduction along with an estimated annual carbon sequestration of 1.5 t C/ha/year. The city of Chengdu faces integration challenges when it comes to landscape integration because its planning processes remain fragmented between different government institutions which create barriers to cooperation[12]. A thorough landscape integration approach remains essential to achieve because the current situation signals an immediate necessity to combine aesthetic goals with functionality requirements alongside ecological objectives and local area concerns.

Research findings indicate extensive theoretical agreement that urban landscapes need cultural and functional and ecological integration, yet their practical execution demonstrates substantial variability across China[85]. The variations in local governmental control and economic evolution alongside different social cultural elements produce regional

differences across China [86]. The literature shows three primary deficiencies in urban design where the public should have more influence in planning stages and ecological measurements must be implemented throughout macro-scale developments and management systems for urban green space need improvement.

5. Conclusions

This research studies Chinese city landscape approaches by examining the relationships between regional cultural traditions and ecological outcomes as well as urban service requirements. Different implementation methods and outcomes emerge from strategies identified throughout diverse contexts even though they share basic theoretical foundations. The ongoing need for customized design solutions emerges from the differences between cities which calls for combining ecosystem performance with cultural aspects and usability requirements for developing appropriate local solutions instead of embracing standard methods.

The study results present research and practice implications for future work. Additional empirical exploration is needed to provide a detailed examination of multiple urban landscaping techniques within different economic environments and ecosystem circumstances. Research efforts need to integrate standardized indicators of ecosystem services (including vegetation cover along with green space for each resident and biodiversity metrics) to demonstrate performance improvements in carbon capture and urban stormwater management and thermal regulation. Advanced design delivery methods will become more effective when deployed among cities of distinct locations.

Secondly stakeholders including urban planners and local communities along with policymakers need additional emphasis to guarantee that ecological sustainability practices in urban design also support community cultural needs and social priorities. The increased inclusion of residents permits the synthesis of local nature-based expertise with modern architectural methods which results in better ecosystem quality and prolonged sustainability of green infrastructure projects.

Urban planners together with designers need to develop comprehensive strategies which unite design excellence with ecological efficiency in their work. The research shows urban planners must adopt highly developed ecological frameworks that help preserve biodiversity protect habitat continuity and strengthen natural ecosystem functionality. A single design platform which combines green infrastructure with ecological networks alongside sustainable planning practices enables achievement of this goal. Integrated design has produced notable ecological benefits in Shenzhen and Hangzhou and Chengdu, but separate planning systems prevent other Chinese cities from achieving similar successes.

5.1. Limitations and Challenges of the Research

Internal limitations throughout this systematic review limit both the overall conclusion validity and analytical depth. The review limitation of peer-reviewed studies after 2018 can cause a reduction of valuable information from historical seminal research and gray literature such as government reports. The diversity of ecological and cultural metrics utilized across studies from percentage vegetation cover changes to social cohesion assessments hinders formal meta-analytical methods which ultimately hampers direct assessment of effect sizes [87]. The review examined research on Chinese urban contexts in general, but first-tier megacity studies (such as Beijing, Shanghai and Guangzhou) dominate the findings which obscure landscape design effectiveness in second- and third-tier urban areas because these locations have different resource availability and governance frameworks [1]. The review's inclusion of only selected English and Chinese databases may have excluded vital studies from other languages and area-specific publications thus producing language and database selection biases [88]. Using citation counts as inclusion criterion prioritized research that gained extensive citations but did not necessarily demonstrate strong methodological quality or contextual compatibility which could promote biased inclusion of specific design paradigms. The emphasis on reported outcomes in this review leaves out important unpublished implementation challenges including maintenance deficits and shifts in stakeholder support and policy reversals which reduce understanding of design intervention sustainability in real-world settings [89]. The findings must be approached with caution when identified limitations are recognized since these constraints will help direct new innovative research projects tackling present deficiencies.

5.2. Future Research Directions

Future research investigations need to establish adaptive management approaches which adjust to changes detected within the environment. Cities improve their adaptation to environmental changes by maintaining ongoing observation of critical ecological markers in combination with repeated design refinements. The adaptive method safeguards both ecological values and establishes long-term urban health and resilience in the process.

The review shows that China needs dual attention to cultural heritage while balancing it with ecological preservation to achieve urban landscape success. A design combination between aesthetic improvements and functional requirements and ecological resilience practices will develop cities having beautiful features and cultural landmarks alongside environmental sustainability. Pressing these integrated strategies forward remains pivotal in building resilient urban communities that unite both modern resident needs with preserved ecosystem functioning. Strategic progress relies on coordinated public administrations together with detailed ecological reviews coupled with flexible neighborhood-based planning systems.

Author Contributions

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Confict of Interest

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