

# Green Third Spaces: Mechanisms and Strategies for Urban Green Spaces Driving Urban Innovation

Fubiao ZHU<sup>1,\*</sup>, Lin LU<sup>2</sup>, Delin ZHUANG<sup>1</sup>, Shengwu JIN<sup>1,\*</sup>, Xueting YANG<sup>3</sup>,  
Xiao YAN<sup>4</sup>

<sup>1</sup> School of Economics, Hefei University of Technology, Hefei 230601, China

<sup>2</sup> School of Geography and Tourism, Anhui Normal University, Wuhu 241003, China

<sup>3</sup> College of Digital Economics & Management, Mianyang Teachers' College, Mianyang 621000, China

<sup>4</sup> Research Institute of Transition of Resource-based Economics, Shanxi University of Finance and Economics, Taiyuan 030006, China

\*CORRESPONDING AUTHORS

Fubiao ZHU

Address: No.485, Danxia Road, Hefei 230601, China

Email: zhufub@hfut.edu.cn

Shengwu JIN

Address: No.485, Danxia Road, Hefei 230601, China

Email: shwjn66@163.com

## ABSTRACT

Urban green spaces are not only ecological spaces but also important economic and social spaces. Enhancing service facilities to cultivate green third spaces and fully leveraging their roles in everyday life, such as social interaction and physical activity, help realize their multidimensional value. However, existing research on everyday-life functions of urban green spaces and their associated externalities, particularly in relation to urban innovation, is insufficient. Based on the literature review and theoretical analysis, this study develops a dual framework through which green third spaces influence urban innovation. At the individual level, green third spaces enhance physical and mental health, stimulate creativity, improve innovation performance, and attract innovative talent. At the spatial level, green third spaces help foster the agglomeration of innovation factors such as talent, promoting the formation of innovation districts and even innovation cities, thereby generating spatial agglomeration effects. This study provides a theoretical foundation for future empirical and case-based studies. It emphasizes cultivating green third spaces to realize the multidimensional value of urban green spaces and proposes spatial strategies of urban innovation, including integrating green third spaces into innovation districts and organizing innovation activities around them.

## KEYWORDS

Green Space; Green Third Space; Urban Innovation; Individual Creativity; Spatial Agglomeration; Everyday Life

## HIGHLIGHTS

- Focuses on the everyday-life functions of urban green spaces and their externalities
- Proposes the dual mechanisms by which green third spaces influence urban innovation
- Proposes landscape design strategies for urban innovation based on green third spaces

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## 1 Introduction

By reviewing the relevant literature, it becomes apparent that scholars do not share a unified definition of urban green space<sup>[1-2]</sup>. The main differences among these definitions lie in the types of spaces included, while a common feature is the emphasis on vegetation cover as the fundamental attribute. In this article, urban green spaces are defined as open spaces dominated by

vegetation or natural elements that are available for public use or provide ecosystem services. Urban green spaces have been widely recognized for their ecological, environmental, social, cultural, health, and recreational benefits<sup>[1-2]</sup>. However, research on urban green spaces and their externalities from the perspective of everyday life remains limited, particularly regarding their social interaction functions and the associated socio-economic effects.

As social spaces beyond home and workplace, third spaces<sup>①</sup> are embedded in everyday life and provide favorable settings for physical activity, leisure, informal social interaction, consumption, and public life<sup>[3-5]</sup>. Existing studies have examined their effects on quality of life<sup>[6-7]</sup>, and the concept has been further developed as a multidimensional construct integrating material and mental dimensions<sup>[8]</sup>. Most urban green spaces can function as third spaces, yet unlike typical third spaces such as cafés and bookstores, they represent a distinct type. Not all urban green spaces qualify as typical third spaces; those that do not are largely potential green third spaces, which lack necessary facilities to support everyday social interactions; while purely non-green third spaces are mainly privately owned and lack publicness. The insufficient attention given in urban planning and landscape design to the third-space functions of urban green spaces constitutes an important motivation of this study.

Innovation is a fundamental driving force of socio-economic development. Promoting innovation has become a key priority for governments worldwide. Innovation activities are inherently spatial and require appropriate physical environments. Location and its effects on innovation output are among the central concerns in innovation studies<sup>[9]</sup>. The relationship between urban space and innovation has attracted increasing scholarly attention<sup>[10]</sup>. Informal interactions and knowledge exchange are widely recognized as important drivers of innovation<sup>[11]</sup>.

Existing studies have examined how third spaces (e.g., cafés) influence innovation, typically through knowledge spillovers<sup>[12-13]</sup>. However, the mechanisms linking third spaces to innovation outcomes remain underdeveloped. Drawing on the third space perspective and emphasizing the public, open, and everyday life functions of urban green spaces, this study aims to systematically explore the mechanisms through which green third spaces influence urban innovation. Specifically, it proposes how green third spaces influence urban innovation through individual creativity and

spatial agglomeration of innovation, thereby providing practical implications for the spatial organization of innovation activities and the effective utilization of urban green spaces. Although different types of third spaces and different contexts may exert heterogeneous effects, the proposed theoretical framework is expected to have broader applicability, with variations arising from differences in the relative strengths of the underlying mechanisms.

## 2 Scattered Research Findings

Although few studies directly examine how urban green third spaces affect urban innovation or its mechanisms, related literature provides evidence for two pathways.

### 2.1 Individual-Level Impact Mechanisms

#### 2.1.1 Green Third Spaces and Individual Creativity

Creativity constitutes the foundation of innovation<sup>[14]</sup>. Jean-Alain Héraud argues that creativity underpins various innovation theories and emphasizes the roles of entrepreneurship, serendipity, and imagination beyond knowledge<sup>[15]</sup>. Existing studies suggest that both environmental and social conditions play an important role in shaping individual creativity, yet their integrated effects remain insufficiently explored. Green environments have been widely shown to improve physical and mental well-being<sup>[16-19]</sup>, while social spaces facilitate interaction and communication, thereby supporting creative thinking<sup>[20]</sup>. By integrating these ecological and social functions, green third spaces provide environments that are conducive to individual creativity, as they simultaneously support well-being and social interaction<sup>[21-23]</sup>.

#### 2.1.2 Attraction of Green Third Spaces to Innovation Talent

Existing literature indicates that green third spaces influence the migration of innovation talent both within and across cities. The creative class is highly migratory due to work-related factors<sup>[24]</sup>. Third spaces, including green third spaces, offer recreation, experience, sense of belonging, restoration, and diversity in people, ideas, and lifestyles, thereby enhancing attractiveness to innovation talent<sup>[25-27]</sup>. Moreover, creative groups tend to prefer regions that are inclusive and rich in creative resources<sup>[28]</sup>. Richard Florida emphasizes the importance of creative class agglomeration, characterized by diversity and creativity<sup>[29]</sup>. Christopher Ling and Ann Dale find that unique landscape communities (e.g., ecological fringe areas) have the higher proportion of creative class<sup>[30]</sup>. Surabhi Pancholi et al. argue that the sense of place can be fostered through public spaces to attract and retain migratory knowledge workers<sup>[31]</sup>.

① Unlike “thirdspace,” which emphasizes relations of rights, and “third place,” which is typically confined to micro-scale contexts, “third space” in this study is conceived as inherently multi-scalar, operating across the micro, meso, and macro levels.

Some scholars hold different views on the role of cultural diversity in attracting innovation talent. Bradley Bereitschaft and Rex Cammack argue that the impact of cultural diversity is limited<sup>[32]</sup>, although different indicators of cultural diversity exert varying effects. H el ene Martin-Brelot et al. suggest that the mobility of the creative class is constrained by cultural and institutional factors<sup>[33]</sup>. However, these different views focus more on migration costs than their effects.

### 2.1.3 Green Third Spaces and Individual Innovation Performance

Green third spaces not only enhance individual creativity and attract innovation talent<sup>[34-35]</sup>, but also may directly improve individual innovation performance. They can enhance innovation performance through physical activity, psychological well-being, and knowledge spillovers<sup>[36]</sup>, which together influence innovation efficiency and output. Yingcheng Li et al. argue that third spaces within innovation districts play a crucial supporting role in the agglomeration of innovation elements, the cultivation of innovative atmosphere, and the organization of innovation activities<sup>[37]</sup>. Third spaces enhance innovation performance by facilitating the exchange of tacit knowledge and fostering an environment conducive to innovation<sup>[37]</sup>, thus linking social interaction with measurable innovation outcomes. Although the above literature does not focus exclusively on green third spaces, these functions apply to them as well.

## 2.2 Spatial-Level Impact Mechanisms

### 2.2.1 Green Third Spaces and Multiscale Innovation Agglomeration

Innovation agglomeration has long been recognized as a key spatial characteristic of innovation activities. Joseph Alois Schumpeter argues that technological innovations often cluster within relatively dense geographic spaces<sup>[38]</sup>, highlighting the importance of spatial conditions in shaping innovation activities. The public and social attributes of green third spaces enable them to play a potential role in the formation of creative cities and innovation districts<sup>[39-40]</sup>. Across multiple spatial scales—within cities, across cities, and among city clusters—innovation exhibits agglomeration characteristics, within which green third spaces may exert a facilitating influence<sup>[27,41-42]</sup>.

Environmental quality at the intercity scale is regarded as a key factor in influencing the formation of innovation districts, and green spaces are considered an integral component of such districts<sup>[43-44]</sup>. Green spaces in innovation districts typically function as green third spaces. Youwei Tan et al. develop an identification framework for innovation districts encompassing spatial dimensions (location,

scale, and neighboring areas) and key elements (innovation assets, physical assets, and network assets); and physical assets include parks and cultural facilities<sup>[44]</sup>. S. Bahar Durmaz analyzes the quality of place in terms of physical, socio-cultural, perceptual, and visual characteristics, emphasizing its impact on creativity and identifying it as a key factor influencing creative agglomeration<sup>[45]</sup>. Niusha Esmaeilpoorarabi et al. advocate for the balanced integration of soft and hard factors, tangible and intangible elements, as well as places and people, to shape innovation districts; and they further argue that locating innovation districts in suburban areas near city centers can increase public participation<sup>[27,43]</sup>.

Innovation agglomeration also occurs at the intercity and city-cluster scales<sup>[46-48]</sup>. At these scales, green third spaces contribute to innovation agglomeration primarily by enhancing urban livability and attracting innovation talent. As an important component of the living environment, green third spaces can promote urban innovation by facilitating the inflow of innovation drivers<sup>[49]</sup>. The importance of urban green spaces in the development of smart cities has also been widely emphasized<sup>[50]</sup>. Moreover, both socio-cultural and ecological environments play a crucial role in sustaining creative cities<sup>[51]</sup>.

### 2.2.2 Spatial Agglomeration Effect of Innovation

Agglomeration economy theory holds that industrial clustering can reduce costs through savings in transaction costs and shared public facilities, and similar mechanisms may also apply to innovation activities. Agglomeration is considered an important force in enhancing urban innovation capacity<sup>[52]</sup>, as the concentration of innovation elements enhances innovation efficiency<sup>[53]</sup>. Philippe Martin and Gianmarco I. Ottaviano argue that innovation agglomeration can lower innovation costs via the monetary effects associated with reduced transaction costs<sup>[54]</sup>. Green third spaces further enhance innovation performance within cities through knowledge spillovers<sup>[55]</sup>.

Both economies of scale theory and external economies theory provide theoretical support for the spatial agglomeration effect of innovation. Li Fang suggests that agglomeration can promote innovation through two pathways: the crowding out of low-end innovative firms and the increased concentration of innovative talent<sup>[56]</sup>. Daniela Doina Fundeanu and Cosmin Sandu Badele argue that agglomeration stimulates innovation activities by fostering intensive interactions, shared facilities, knowledge and experience exchange, technology transfer, networking, and information dissemination<sup>[57]</sup>. Some scholars stress the importance of non-local relationships and cognitive proximity, arguing that excessive

geographic closeness may lead to spatial lock-in and limit access to new knowledge<sup>[58-59]</sup>.

Overall, the existing studies remain fragmented, lacking an integrated framework that links individual-level creativity and spatial-level agglomeration mechanisms. The deeper understanding of the mechanisms can provide a theoretical basis for spatial innovation strategies.

### 3 Theoretical Hypotheses

#### 3.1 Individual Creativity Hypotheses

Building upon the literature review and by integrating multidisciplinary theories, this study proposes the mechanism through which green third spaces influence individual creativity (Fig. 1). According to the relevant theories<sup>[60-65]</sup>, individual creativity can be categorized into four aspects: labor creativity, emotional creativity, health-related creativity, and intellectual creativity.

Karl Heinrich Marx argues that free time includes leisure and creative activity time, which plays an important role in the renewal and recovery of labor capacity<sup>[65]</sup>. Therefore, this study argues that

green third spaces are important spatial carriers of free time and have positive effects on labor creativity.

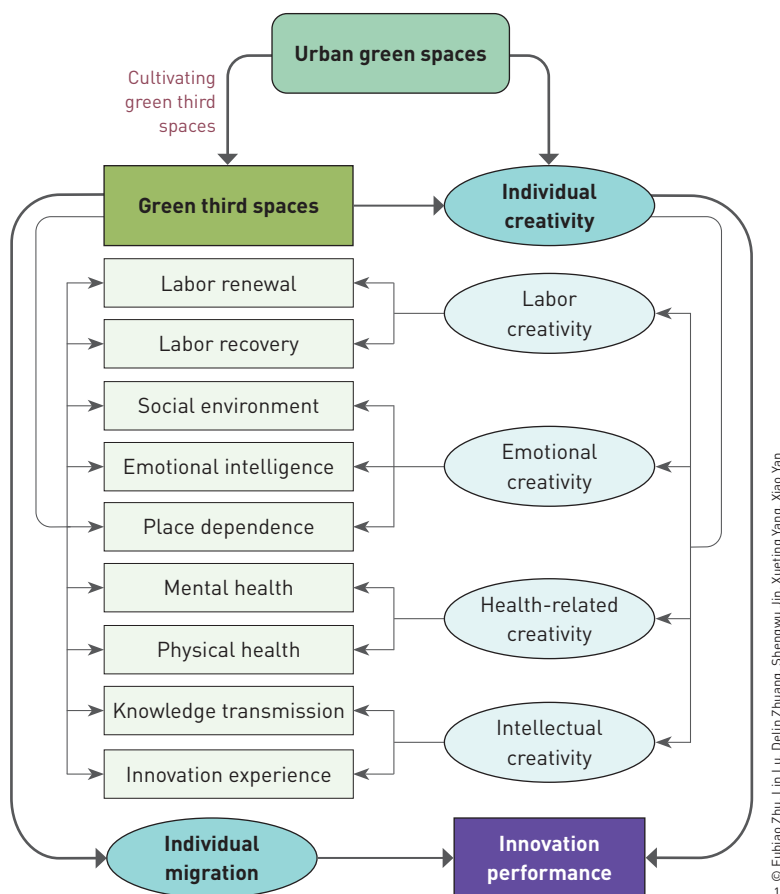
Theories of flow, emotional intelligence, field theory, and place dependence provide the theoretical foundation for emotional creativity<sup>[60-63]</sup>. Building on this, this study suggests that green third spaces offer innovators favorable social environments and psychological spaces, thereby enhancing their emotional intelligence and emotional creativity.

As discussed above, green third spaces have positive effects on physical and mental health. Health status affects not only innovators' work engagement but also their innovation efficiency, for which health-related creativity is an important component of individual creativity<sup>[66]</sup>.

Meanwhile, green third spaces provide venues for social interaction and create opportunities for exchanges among innovators. According to the learning curve theory<sup>[64]</sup>, face-to-face interaction facilitates knowledge transmission and the acquisition of innovative experience, thereby enhancing innovators' intellectual creativity. Thus, green third spaces can boost individual creativity and promote innovation by fostering intellectual creativity.

Green third spaces also influence innovation by attracting the migration of innovation talent, while green spaces themselves exert direct positive effects on individual creativity and innovation<sup>[23]</sup>.

Fig. 1 Theoretical framework of individual creativity.



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#### 3.2 Spatial Agglomeration Hypotheses

Grounding in location theory, economies of scale theory, externality theory, learning curve theory, and transaction cost theory<sup>[67-71]</sup>, this study proposes the spatial agglomeration mechanism through which green third spaces influence urban innovation (Fig. 2). The multidimensional attributes of ecology, economy, and society give green third spaces inherent attractiveness to innovation groups and activities. As a result, green third spaces may promote the agglomeration of innovation across different spatial scales, including intracity, intercity, and city cluster levels. The impact of green third spaces on urban innovation may be heterogeneous across spatial scales<sup>[72]</sup>, resulting from the combined effects operating at multiple scales.

The spatial agglomeration of innovation induced by green third spaces may yield positive effects on urban innovation. Specifically, such agglomeration helps attract innovation resources, generate economies of scale and demonstration effects, facilitate communication and collaboration among R&D personnel, and reduce transaction costs<sup>[67-71]</sup>. For some firms, the impact of innovation agglomeration may be double-edged<sup>[56]</sup>. Spatial competition may lead to a crowding-out effect on low-end

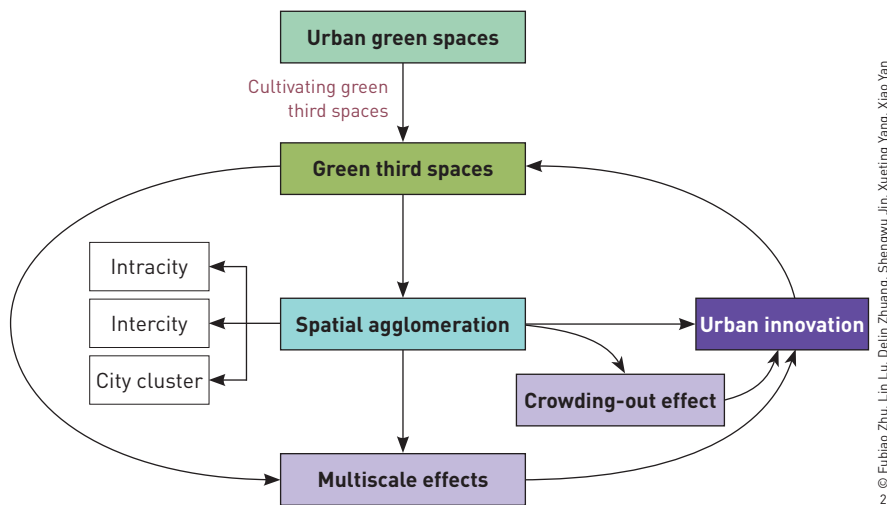


Fig. 2 Theoretical framework of spatial agglomeration.

innovation, thereby influencing spatial innovation outcome. Green third spaces influence land and real estate values<sup>[73]</sup>, which may constrain innovation activities for low-end or small firms. Firms located in greener surroundings are more likely to appoint senior executives with environmental expertise, and to place greater emphasis on environmental information disclosure, thereby exerting a crowding-out effect on non-green innovation<sup>[74]</sup>. Despite their crowding-out effects on certain types of innovation, green third spaces have an overall predominantly positive impact.

The spatial agglomeration mechanism through which green third spaces promote innovation is not merely theoretical. Studies confirm their positive effects on corporate innovation and observe the formation of innovation agglomeration around such spaces, although living amenities and public facilities also contribute to enhancing local quality<sup>[27,75]</sup>.

Empirical research is needed to further examine the relationship between green third spaces and innovation agglomeration. Direct measures of innovation spatial agglomeration remain limited. However, by using the spatial distribution of innovation activities or the scale of innovation spaces as proxies, and employing industry agglomeration metrics such as the spatial Gini coefficient<sup>[76]</sup> and the Duranton–Overman index<sup>[77]</sup>, it is possible to quantify the level of innovation agglomeration. Such empirical analysis can provide an evidence base for landscape design, urban planning, and urban innovation policies.

Although this study proposes both individual creativity and spatial agglomeration mechanisms, these two mechanisms are not independent. Improvement in individual creativity may contribute to the formation of innovation agglomeration. In turn, innovation

agglomeration not only enhances individual creativity through learning effects, but may also attract more innovation talent because of the increased job opportunities and improved living conditions. Green third spaces influence urban innovation through both mechanisms, which operate simultaneously and reinforce each other.

## 4 Research Prospects and Practical Insights

### 4.1 Research Prospects

Based on the literature review and multidisciplinary theories, this article identifies the individual creativity and spatial agglomeration mechanisms, through which green third spaces influence urban innovation, highlighting the potential of urban green spaces in promoting innovation. However, the case studies and empirical analyses are still lacking and remain essential for validating the proposed mechanisms.

It is necessary to evaluate the impact of green third spaces on individual creativity from the micro level. Although the existing studies suggest positive effects<sup>[19,34]</sup>, the underlying mechanisms and the magnitude of the effects require more rigorous validation. Using micro-level survey data to assess individual creativity and identify key influencing pathways can help refine the theoretical understanding of how green third spaces affect innovation. This is also essential for optimizing the spatial configuration and functional design of green third spaces.

Operationally, individual creativity and its four dimensions can be treated as latent variables, with the specific aspects shown in Fig. 1 as manifest variables<sup>[60–65]</sup>. These can be measured through questionnaire-based self-evaluations from R&D personnel. Green third spaces can be operationalized using indicators such as accessibility or distance, while innovation output may be proxied by patent data. A mediation framework, such as PLS-SEM (partial least squares structural equation modeling), can be employed to test the micro-level mechanism linking green third spaces, individual creativity, and innovation outcomes. Additional city-scale survey data are needed to examine how green third spaces influence the migration of innovation talent.

At the macro level, further research is required to assess the impact of green third spaces on urban innovation and to examine the spatial agglomeration mechanism. By combining macro-level data with multiscale, agglomeration, and crowding-out effects, it is possible to evaluate these relationships more comprehensively. Empirical models can be developed based on the Cobb–Douglas production function<sup>[78]</sup>, conceptualizing innovation as the joint

outcome of labor, capital, economic conditions, and green third spaces. Estimation methods such as two-way fixed effects or causal forests can be applied. In addition, innovation agglomeration can be incorporated into mediation models to examine indirect effects.

Case studies are also essential for validating and contextualizing the proposed mechanisms. Future research may draw on leading international innovation districts, such as Kendall Square, Diamantina Knowledge Precinct, and Underbroen<sup>[31,79-80]</sup>, as well as emerging innovation areas in China, including Lixin Lake Sci-Tech Headquarters District, Songshan Lake Science and Technology Industrial Park, and Guiyang Big Data Sci-Tech City, to examine how green third spaces influence individual creativity and innovation agglomeration in different contexts.

#### 4.2 Practical Insights

Third spaces are often regarded as key elements underpinning the success of innovation districts<sup>[31,79-80]</sup>. Building on this, green third spaces can be understood as an important spatial strategy for enhancing innovation performance. Integrating green third spaces into existing innovation and entrepreneurship complexes, innovation districts, and innovation cities may help promote urban innovation.

Although direct empirical evidence remains limited, green third spaces are widely considered integral components of innovation environments<sup>[43-44]</sup>. Observations from practice also suggest that innovation activities and elements tend to cluster around such spaces. Therefore, planning strategies should emphasize the coordinated development of green third spaces and innovation activities, including integrating green third spaces within innovation districts and organizing innovation functions around them.

### 5 Conclusions

This study explores the mechanisms through which green third spaces promote urban innovation, focusing on individual creativity and spatial agglomeration. Green third spaces influence innovation by enhancing multiple dimensions of individual creativity. They also contribute to the agglomeration of innovation talent and other factors, thereby shaping urban innovation patterns and outputs. While spatial agglomeration may generate crowding-out effects on certain types of innovation, its overall impact remains predominantly positive. These processes may operate across multiple spatial scales, with the two mechanisms interacting dynamically and reinforcing each other.

Based on the conclusions, this article highlights the importance

of orienting urban green spaces toward green third spaces that support everyday activities, thereby enhancing their economic, social, and ecological value while contributing to innovation. It proposes strategies for integrating green third spaces into innovation districts and for organizing innovation activities around such spaces. Some innovation districts may lack the foundation for large green third spaces embedded within them; but open, shared, small-scale green third spaces can also have positive effects. However, the agglomeration of innovation talent and other factors may have a certain crowding-out effect on the public access to these green third spaces, potentially leading to gentrification. Conflicts between communities and innovation districts need to be addressed, and the governance of green third spaces should be strengthened.

This study provides a theoretical foundation for subsequent empirical and case-based studies. Nevertheless, the proposed framework requires further empirical validation, and the effects of green third spaces may vary across different socio-spatial contexts. Although the background differences, such as climate, culture, and institutions, do not weaken the general applicability of the mechanisms of the biological individual creativity and the economic innovation agglomeration, they may moderate the extent to which green third spaces affect urban innovation, leading to heterogeneous effects. Future research should include survey-based studies to examine the individual creativity, multiscale empirical analyses to investigate the spatial agglomeration, and comparative case studies to explore context-specific dynamics. These efforts will help deepen understanding of how green third spaces can support more innovative and livable environments. Finally, although this paper mainly focuses on green third spaces, the findings are generally applicable to other types of third spaces, while some differences may still exist. Research on different types of third spaces is also necessary.

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**Competing interests** | The authors declare that they have no competing interests.

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# 绿色第三空间：城市绿色空间促进城市创新的机制与策略

朱付彪<sup>1,\*</sup>, 陆林<sup>2</sup>, 庄德林<sup>1</sup>, 晋盛武<sup>1,\*</sup>, 杨雪婷<sup>3</sup>, 阎晓<sup>4</sup>

- 1 合肥工业大学经济学院, 合肥 230601
- 2 安徽师范大学地理与旅游学院, 芜湖 241003
- 3 绵阳师范学院数字经济与管理学院, 绵阳 621000
- 4 山西财经大学资源型经济转型研究院, 太原 030006

\*通信作者  
朱付彪  
地址: 合肥市丹霞路485号  
邮编: 230601  
邮箱: zhufub@hfut.edu.cn  
晋盛武  
地址: 合肥市丹霞路485号  
邮编: 230601  
邮箱: shwjin66@163.com

## 摘要

城市绿色空间不只是生态空间, 还是重要的经济空间和社会空间。通过完善服务设施来培育绿色第三空间, 充分发挥其在日常生活中的作用 (如社会交往和体育运动), 有助于实现其多维价值。然而, 现有文献对城市绿色空间的日常生活功能及其外部性, 特别是城市创新效应的研究仍不够充分。基于文献和理论分析, 本文构建了一个双重框架, 以解释绿色第三空间如何影响城市创新: 个体层面, 绿色第三空间能够促进身心健康、激发创造力、提升创新绩效, 并吸引创新人才; 空间层面, 绿色第三空间有助于人才等创新要素集聚, 促进创新街区甚至创新城市的形成, 并产生空间集聚效应。本文强调通过培育绿色第三空间来实现城市绿色空间的多维价值, 并提出城市创新的空间策略, 即将绿色第三空间嵌入创新街区以及环绿色第三空间布局创新活动, 以期为未来的实证研究和案例研究奠定理论基础。

## 关键词

绿色空间; 绿色第三空间; 城市创新; 个体创造力; 空间集聚; 日常生活

## 文章亮点

- 聚焦城市绿色空间的日常生活功能及其外部性
- 提出绿色第三空间影响城市创新的双重机制
- 提出面向城市创新的绿色第三空间景观设计策略

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