

Urban Greening and Ecological Balance in the United States: Policies, Practices, and Challenges

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doi:10.56397/JPEPS.2024.09.11

Abstract

Urbanization is a significant hallmark of modern societal development. However, the environmental issues that accompany it, especially the disruption of ecological balance, have become a global challenge. Urban greening, as an essential means of improving the urban ecological environment and promoting ecological balance, is increasingly recognized for its importance. The United States, with one of the highest levels of urbanization globally, serves as a model for urban greening policies and practices worldwide. This paper provides an in-depth analysis of the current state, policies, practices, and challenges of urban greening in the United States, aiming to offer strategies and recommendations for sustainable urban greening development.

Keywords: urban greening, ecological balance, policies, practices, challenges, United States

1. Introduction

As the process of global urbanization accelerates, urban environmental issues are becoming increasingly prominent, posing a critical constraint on sustainable urban development. The United States, with one of the highest levels of urbanization globally, faces particularly severe environmental challenges in its urbanization process. Urban heat island effect, loss of biodiversity, water resource scarcity, and air pollution not only affect the quality of life for urban residents but also pose threats to the ecological balance of cities. The urban heat island effect refers to the phenomenon where urban areas have higher temperatures than surrounding rural areas due to the absorption and re-radiation of solar radiation by man-made surfaces such as buildings and roads. This phenomenon not only increases the risk of heat

stress for urban residents but also exacerbates energy consumption and greenhouse gas emissions. The loss of biodiversity weakens the stability and resilience of urban ecosystems, reducing the city's adaptability to environmental changes.

2. Significance of the Study

In this context, urban greening, as an effective means of environmental management, plays an increasingly important role in improving the urban ecological environment and promoting ecological balance. Urban greening can not only reduce urban temperatures and mitigate the heat island effect by increasing green spaces but also protect and increase biodiversity by providing habitats and food sources. Moreover, urban greening can improve air quality, reduce noise pollution, and enhance urban landscape value, thereby improving the quality of life and health levels of residents. Therefore, studying the current state, policies, practices, and challenges of urban greening in the United States is of significant theoretical and practical importance for formulating effective urban greening strategies and promoting sustainable urban development.

The implementation of urban greening requires a comprehensive consideration of natural conditions, social needs, and economic costs, making it a complex systematic project. The policies and practices of urban greening in the United States provide valuable experience and insights for other countries. However, urban greening in the United States also faces challenges such as insufficient funding, tight land resources, and low public participation. How to overcome these challenges through scientific planning and management to achieve sustainable urban greening is an urgent issue to be addressed.

This paper aims to provide a comprehensive analysis of urban greening in the United States, discuss its role in improving the urban ecological environment and promoting ecological balance, identify existing challenges, and propose corresponding strategies and recommendations. Through this research, it is hoped to provide valuable references and insights for policymakers, urban planners, and environmental scientists to jointly promote the scientific development and innovative practice of urban greening.

3. Overview of Urban Greening Policies in the United States

Urban greening policies serve as the basic guidelines for guiding and regulating urban greening activities, playing a crucial role in protecting and improving the urban ecological promoting environment and sustainable development. As a country with a high level of urbanization, the United States has urban greening policies and regulations that have played a significant role in advancing urban greening and maintaining ecological balance. This chapter will provide an overview of the policies and regulations of federal and local governments in the United States on urban greening and analyze the background, objectives, and implementation effects of these policies.

3.1 Federal Government's Urban Greening Policies

The federal government's urban greening

policies in the United States mainly focus on environmental protection and natural resource management. The following are some of the main federal policies and regulations:

- National Environmental Policy Act (NEPA): Enacted in 1969, it requires the federal government to assess the environmental impact of any major construction project before it proceeds, including potential impacts on urban greening.
- Clean Air Act (CAA): Aims to improve air quality and reduce air pollution, indirectly promoting urban greening as plants can absorb pollutants from the air.
- Endangered Species Act (ESA): Protects endangered species and their habitats, and urban greening projects need to consider the impact on these species.

3.2 Local Government's Urban Greening Policies

Local governments have more specific and diverse policies and regulations on urban greening, usually including urban planning, land use, and public space management. The following are typical policies of local governments:

- Urban Greening Master Plan: Many cities have formulated detailed greening plans, clarifying greening goals, strategies, and implementation steps.
- Green Belts and Park Construction: Local governments increase the green coverage of cities by building parks, green belts, and other green spaces.
- Green Buildings and Rooftop Greening: Encourage and regulate the design of green buildings and promote rooftop greening to increase urban vertical greening.

3.3 Background of Policy Formulation

The formulation of urban greening policies in the United States has a complex and diverse background, mainly including the following aspects:

• Environmental Protection Needs: With the development of industrialization and urbanization, environmental pollution and ecological destruction are becoming increasingly serious, and urban greening has become an important means of environmental improvement.

- **Improving Residents' Quality of Life**: Urban greening can improve the quality of life for residents by providing places for leisure, entertainment, and exercise.
- Economic Development: Urban greening helps to enhance the city's image, attract investment and tourism, and promote economic development.
- Climate Change Response: Urban greening plays an important role in mitigating climate change and reducing greenhouse gas emissions.

3.4 Policy Objectives

The main objectives of urban greening policies in the United States include:

- **Increasing Green Space**: Increase the green coverage of cities by building parks, green belts, and other green spaces.
- **Improving Air Quality**: Improve air quality by absorbing carbon dioxide and other pollutants through plant photosynthesis.
- **Protecting Biodiversity**: Protect and increase biodiversity by protecting and restoring natural habitats.
- Enhancing Resident Health: Promote the physical and mental health of residents by providing places for leisure and exercise.

3.5 Policy Implementation Effects

Although the United States has made certain progress in urban greening, the effects of policy implementation still vary. The following are some of the main implementation effects:

- **Increased Green Space**: Many cities have successfully increased parks and other green spaces, improving the quality of life for residents.
- **Improved Air Quality**: Some cities have significantly improved air quality through urban greening, reducing air pollution.
- **Biodiversity Protection**: Some cities have achieved certain results in biodiversity protection in urban greening projects.
- Increased Resident Participation:

Through public participation and community greening projects, the attention and participation of residents in urban greening have been increased.

4. Case Study of Urban Greening Practices

Urban greening in the United States demonstrates a variety of practice models in different cities, reflecting not only the natural environment and cultural characteristics of each place but also the innovation and efforts of city managers in responding to environmental challenges. This chapter analyzes several representative cases of urban greening in the United States, discussing their successful experiences and challenges, and discusses the adaptability and sustainability of these models.

4.1 New York City: Green Roofs and Urban Agriculture

New York City is known for its high-density urban structure and limited ground space, so it has innovatively adopted vertical greening methods such as green roofs and urban agriculture. Green roofs not only increase the city's green coverage but also help reduce building energy consumption and improve air quality. Urban agriculture provides fresh agricultural products for city residents by utilizing roof spaces and abandoned plots, also enhancing community cohesion. However, the implementation and maintenance of these projects require high costs, and the uneven popularity in different urban areas affects their overall benefits.

4.2 Los Angeles: Parks and Green Belts

Los Angeles has significantly increased its green coverage through large-scale park and green belt construction. The greening project of the Los Angeles River not only restores the natural ecology of the river but also provides leisure and entertainment venues for citizens. In addition, through the "One Million Trees Initiative," Los Angeles has increased the number of city trees, improving the city's air quality and heat island effect. Despite the significant progress, Los Angeles's urban greening still faces challenges such as insufficient funds and tight land resources, and the distribution of greening resources in different urban areas is uneven.

4.3 Chicago: Urban Forests and Community Gardens

Chicago is known for its urban forest and community garden projects. The urban forest project increases the city's green space by

planting a large number of trees, helping to reduce urban floods and improve air quality. Community garden projects enhance community and residents' cohesion environmental awareness by encouraging residents to participate in planting and maintenance. However, the management and maintenance of urban forests require a lot of funds and manpower, and the scale and sustainability of community gardens also need to be further improved.

4.4 San Francisco: Urban Parks and Coastal Greening

San Francisco has significantly improved the city's ecological environment through the construction of urban parks and coastal greening projects. Golden Gate Park and waterfront parks not only provide leisure and entertainment venues for citizens but also help protect the coastline from erosion. In addition, San Francisco has increased the city's green space and biodiversity through the "Green City Plan." However, the maintenance cost of coastal greening is high, and the management and maintenance of urban parks also require more funds and technical support.

4.5 Adaptability and Sustainability Discussion

The adaptability and sustainability of different urban greening models are key to achieving the goals of urban greening. Successful urban greening projects need to consider factors such funding, technical support, public as policy participation, and support comprehensively. For example, New York City's green roofs and urban agriculture projects are suitable for high-density urban environments, while Los Angeles's park and green belt construction is suitable for cities with more land. San Francisco's coastal greening needs to consider the impact of the marine environment. Through scientific planning and public participation, the adaptability and sustainability of urban greening projects can be improved to achieve more effective urban greening.

5. The Scientific Basis of Urban Greening and Ecological Balance

Urban greening is not only an important part of urban beautification but also a key factor in maintaining urban ecological balance. With the acceleration of urbanization, urban ecosystems are facing unprecedented challenges. This chapter will discuss the composition and function of urban ecosystems and the specific impact of urban greening on ecological balance, especially its role in carbon sinks and biodiversity protection.

5.1 Composition of Urban Ecosystems

Urban ecosystems are complex systems formed by the interaction of biological communities, abiotic environments, and human activities in cities. The main components include:

- **Biological Components**: Including plants, animals, and microorganisms in cities. Plants play a particularly important role in urban ecosystems, providing oxygen, absorbing carbon dioxide, and providing food and habitats for animals.
- Abiotic Components: Including soil, water bodies, and atmosphere in cities. These abiotic factors have a direct impact on the stability and biodiversity of urban ecosystems.
- Human Activities: The production, life, and consumption activities of humans are an important part of urban ecosystems and have a decisive effect on the healthy development of urban ecosystems.

5.2 Functions of Urban Ecosystems

The functions of urban ecosystems are multifaceted, mainly including:

- **Material Cycle**: Urban ecosystems participate in the cycles of carbon, nitrogen, water, and other materials through the photosynthesis and respiration of plants.
- Energy Flow: The energy in urban ecosystems mainly enters the system through the photosynthesis of plants and is transferred and transformed among organisms.
- **Biodiversity Maintenance**: Urban ecosystems provide habitats for a variety of organisms, helping to maintain and increase biodiversity.
- Environmental Regulation: Urban ecosystems regulate urban climate and mitigate the urban heat island effect through the transpiration and photosynthesis of vegetation.

5.3 Impact of Urban Greening on Ecological Balance Urban greening plays a crucial role in

maintaining urban ecological balance, specifically in the following aspects:

- **Carbon Sink Function**: Urban greening absorbs carbon dioxide from the atmosphere through plant photosynthesis, reducing the concentration of greenhouse gases and combating global climate change.
- **Biodiversity Protection**: Urban greening provides habitats for wild animals and plants, helping to protect and increase urban biodiversity. Different types of vegetation structures can attract different species, increasing the complexity stability and of the ecosystem.
- Climate Regulation: Urban greening reduces surface temperature by increasing urban vegetation coverage, reducing the urban heat island effect. The transpiration of plants can also increase air humidity and improve the urban microclimate.
- **Hydrological Regulation**: Urban greening helps reduce surface runoff and increase groundwater recharge. Vegetation can absorb and store rainwater, reducing the risk of urban floods.
- Air Quality Improvement: Urban greening reduces air pollutants through the adsorption and absorption of plants, improving urban air quality.

5.4 Challenges and Opportunities of Urban Greening

Although urban greening plays an important role in maintaining ecological balance, it also faces some challenges in the implementation process. For example, urban space is limited, and greening land is often in competition with other urban functional needs. In addition, the management and maintenance of urban greening also require a lot of funds and manpower. However, with the widespread adoption of sustainable urban development concepts and technological advancements, urban greening also faces new opportunities. Through scientific planning and technological innovation, the efficiency and benefits of urban greening can be improved to achieve a win-win situation for ecology, society, and economy.

6. Challenges and Strategies for Urban Greening

Urban greening, as an important means to improve the urban ecological environment, has attracted increasing attention worldwide. However, this process is not without challenges. This chapter will discuss the main challenges faced by urban greening in the implementation process and propose corresponding strategies.

6.1 Challenges Faced

Funding Constraints: Urban greening projects usually require a large amount of initial investment and ongoing maintenance costs. Many cities have limited funding in their fiscal budgets for greening projects, making it difficult to implement or sustain greening projects. Insufficient funds have become one of the main factors limiting the development of urban greening.

Land Use Conflicts: With the advancement of urbanization, urban land resources are becoming increasingly scarce. Urban greening land is often in conflict with other urban functional land uses (such as residential, commercial, industrial, etc.). Improper land use planning will limit the development space for urban greening.

Lack of Public Awareness: The public's understanding of the importance of urban greening is insufficient, and there is a lack of participation and support. Without the active participation of the public, urban greening projects are difficult to achieve the expected effects and may even be damaged.

Management and Maintenance Issues: The management and maintenance of urban greening projects are a long-term and complex process. The lack of effective management mechanisms and maintenance measures can lead to poor greening effects and even have negative environmental impacts.

6.2 Strategies for Response

Policy Support: The government should increase financial support for urban greening projects to ensure sufficient funds for the implementation and maintenance of greening projects. At the same time, optimize land use planning, prioritize green space in urban planning, and reasonably layout urban greening space to reduce conflicts with other urban functional land uses.

Enhancing Public Participation: Through publicity, education, and community participation activities, raise public awareness of

the importance of urban greening and enhance public participation and support. The active participation of the public is key to the success of urban greening.

Technological Innovation: Apply water-saving technologies, promote local plants, and use intelligent technologies to improve the management efficiency and effectiveness of greening projects. For example, using water-saving irrigation technology can improve the survival rate of greening plants in arid areas, while intelligent irrigation systems can improve the accuracy of management.

Optimization: Management Establish а long-term management mechanism, formulate scientific and reasonable greening management the main standards, clarify body of responsibility, and ensure the long-term effective operation of greening projects. Strengthen greening maintenance, regularly inspect and maintain greening facilities, and ensure the durability and stability of greening effects.

Implementation of Performance Evaluation: Conduct regular performance evaluations of urban greening projects and adjust and optimize greening strategies in a timely manner. Evaluations can identify problems, summarize experiences, and provide references for future greening projects.

7. Application of Environmental Science and Landscape Design in Urban Greening

Urban greening is not only an initiative to beautify the urban environment but also a scientific practice that requires the joint participation of environmental science and landscape design. Through scientific planning and design, urban greening can more effectively promote ecological balance and improve the quality of life for urban residents.

7.1 Application of Environmental Science in Urban Greening

Environmental science provides a theoretical basis and technical support for urban greening. It involves in-depth research on urban ecosystems, including urban climate, soil, water quality, and biodiversity. Through research in environmental science, a better understanding of the impact of urban greening on urban ecosystems can be achieved, leading to the formulation of more scientific and effective greening strategies.

• Urban Climate Regulation: Research in

environmental science has shown that urban greening can regulate urban climate by increasing vegetation coverage, reducing the urban heat island effect. Reasonable layout of green space can effectively improve the urban microclimate and enhance the comfort of urban residents.

- **Biodiversity Protection**: Urban greening is an important means of protecting and increasing urban biodiversity. Environmental science guides urban greening projects in selecting appropriate plant species through the study of biological communities in urban ecosystems, providing suitable habitats for wildlife.
- Water Quality and Soil Improvement: Urban greening helps improve urban water quality and soil structure through the root system of vegetation and soil microbial activity. Environmental methods science provides for monitoring and assessing the impact of urban greening on water quality and soil, providing a scientific basis for the sustainable development of urban greening.

7.2 Role of Landscape Design in Urban Greening

Landscape design is a key link in achieving urban greening goals. It not only focuses on the aesthetic effects of greening but also pays attention to the ecological functions and social benefits of greening. Through carefully designed landscape gardens, the overall effect of urban greening can be enhanced, promoting the harmonious development of urban greening and ecological balance.

- Landscape Aesthetics: Landscape design creates beautiful and harmonious urban landscapes through plant configuration, terrain shaping, and water feature design. These landscapes not only enhance the visual appeal of the city but also provide spaces for residents to relax and unwind.
- Ecological Functions: Landscape design focuses on the ecological functions of plants, such as air purification, soil and water conservation, and biological habitats. By reasonably selecting plant species and configuration methods, the ecological benefits of plants can be

maximized to improve the health and stability of the urban ecosystem.

Social Benefits: Landscape design also focuses on the social benefits of greening projects, such as providing community activity spaces and enhancing community cohesion. By designing interactive landscape spaces, it can promote communication and interaction among residents and enhance the vitality and cohesion of the community.

7.3 Combination of Environmental Science and Landscape Design

The combination of environmental science and landscape design provides a comprehensive solution for urban greening. Environmental science provides the scientific basis for urban greening, while landscape design translates these scientific foundations into specific implementation strategies. Through the organic combination of the two, urban greening projects can be both scientifically sound and aesthetically pleasing.

- Scientific Planning: During the urban greening planning stage, environmental science provides data and analysis on urban climate, soil, water quality, etc., helping planners formulate reasonable greening layouts and plant selection plans.
- **Design Implementation**: During the implementation stage of greening projects, landscape design translates the research results of environmental science into specific design plans, ensuring the ecological and aesthetic effects of greening projects.
- Continuous Management: After the greening completion of projects, environmental science and landscape design continue to play a role, guiding the continuous management and greening optimization of projects through monitoring and evaluation of greening effects.

8. Urban Greening Strategies from an Interdisciplinary Perspective

Urban greening is a multidimensional and interdisciplinary complex process, involving multiple fields such as environmental science, urban planning, and sociology. Through interdisciplinary collaboration, urban greening can be implemented and developed more comprehensively and effectively.

8.1 Importance of Interdisciplinary Perspective

Contribution of Environmental Science: Environmental science provides the foundational theoretical support needed for urban greening, including ecosystem services, biodiversity protection, and climate change adaptation. Research in environmental science helps better understand the impact of urban greening on urban ecosystems, providing a scientific basis for urban greening.

Role of Urban Planning: Urban planning is a key link in achieving urban greening goals. Urban planners ensure that urban greening is coordinated with urban development through rational layout of urban space. Urban planning also involves land use, transportation planning, and public facility layout, directly affecting the implementation of urban greening.

Perspective of Sociology: Sociology focuses on the social impact of urban greening, including residents' quality of life, community cohesion, and social equity. Sociological research helps understand residents' needs and expectations for urban greening, enhancing public participation and social benefits of urban greening projects.

8.2 Case Study of Interdisciplinary Cooperation

Green Infrastructure Projects: Many cities have achieved collaborative efforts among environmental science, urban planning, and sociology through green infrastructure projects. For example, New York City's "Green Roof" project not only increases urban green space but also enhances residents' environmental awareness and community cohesion through community participation and educational activities.

Urban Agriculture Projects: Urban agriculture projects integrate agricultural activities into urban spaces, combining environmental science, urban planning, and sociology. These projects not only improve the city's food self-sufficiency but also provide residents with opportunities to participate in agricultural activities, enhancing community vitality.

Urban Parks and Public Spaces: The design and management of urban parks and public spaces require the joint participation of environmental science, urban planning, and sociology. Through scientific planning and design, these spaces not only provide leisure and entertainment venues but also help improve urban climate and protect biodiversity.

8.3 Strategic Recommendations

Strengthening Interdisciplinary Education and Training: Interdisciplinary education and training cultivate professionals with multidisciplinary knowledge backgrounds, providing intellectual support for urban greening.

Promoting Interdisciplinary Communication and Collaboration: Establishing communication mechanisms for interdisciplinary collaboration promotes information exchange and knowledge sharing among different disciplines. Through interdisciplinary cooperation, a unified urban greening strategy can be formed.

Encouraging Public Participation: Community participation and public education activities raise public awareness of the importance of urban greening, enhancing public participation and support. Public participation is key to the success of urban greening.

Implementing Interdisciplinary Assessment and Monitoring: Interdisciplinary assessment and monitoring provide a comprehensive understanding of the effects of urban greening, allowing for timely adjustments and optimizations of urban greening strategies.

9. Future Trends and Prospects of Urban Greening in the United States

With the acceleration of global urbanization, urban greening, as an important means of improving urban ecological environment and residents' quality of life, is becoming increasingly important. This chapter will discuss the future development trends of urban greening in the United States and how to achieve more sustainable urban greening through scientific innovation and policy support.

9.1 Future Development Trends

Expansion of Green Space: With the increasing demands of urban residents for health and quality of life, future urban greening will pay more attention to the expansion and optimization of green space. Urban parks, community gardens, rooftop gardens, etc., will become more popular, providing residents with more opportunities for natural contact.

Emphasis on Ecological Balance: Urban greening will pay more attention to ecological balance, protecting and increasing urban biodiversity through scientific planning and design, enhancing the stability and resilience of urban ecosystems.

Adaptation to Climate Change: Facing the challenges brought by global climate change, urban greening will pay more attention to adapting to climate change, reducing the urban heat island effect by increasing vegetation coverage and improving urban microclimate, enhancing the city's adaptability to extreme climates.

Application of Technology Integration: Future urban greening will make more use of modern technology, such as remote sensing technology, Geographic Information Systems (GIS), intelligent irrigation systems, etc., to improve the planning, implementation, and management efficiency of urban greening.

9.2 Promotion of Scientific and Technological Innovation

Application of Intelligent Technology: Intelligent technology, such as drone monitoring, intelligent irrigation systems, and environmental sensors, can more accurately monitor and manage urban greening projects, improving greening effects and resource utilization efficiency.

Development of Water-saving Technology: Facing the challenge of increasingly scarce water resources, water-saving technology will be more widely used in urban greening. Using rainwater collection systems, drip irrigation, and sprinkler irrigation technology, can more effectively utilize limited water resources, improving the survival rate and growth quality of greening plants.

Promotion of Native Plants: Promoting the use of native plants that are adapted to local climate and soil conditions can not only reduce dependence on the external environment but also improve the sustainability of greening and protect and increase local biodiversity.

9.3 Strengthening of Policy Support

Increase in Financial Input: The government should increase financial support for urban greening projects, ensuring sufficient funds for the implementation and maintenance of greening projects. At the same time, encourage private sectors and communities to participate in urban greening through tax incentives and subsidies.

Improvement of Regulations and Standards: Formulate and improve regulations and standards related to urban greening, such as green coverage rate, plant species selection, maintenance management, etc., to provide clear guidance and norms for urban greening.

Promotion of Public Participation: Through publicity education and community participation activities, raise public awareness of the importance of urban greening, and enhance public participation and support. Public participation is key to the success of urban greening.

10. Conclusion

Urban greening plays a crucial role in the ecological balance in the United States. Through in-depth analysis in this thesis, it can be seen that urban greening not only enhances the aesthetic value of the city but more importantly, it plays a significant role in regulating climate, protecting biodiversity, improving air quality, and enhancing the quality of life for residents. However, this process is not without challenges. Funding constraints, land use conflicts, lack of public awareness, and management and maintenance issues are the main obstacles faced by current urban greening.

In the face of these challenges, interdisciplinary cooperation is particularly important. The collaborative effect of disciplines such as environmental science, urban planning, and sociology provides a comprehensive perspective and solutions for urban greening. Environmental science provides theoretical support for ecosystem services and biodiversity protection, laying the foundation for the scientific planning and implementation of urban Urban planning greening. ensures the coordination of greening projects with overall urban development, optimizing land use and spatial layout. Sociology focuses on the social impact of greening projects, enhancing public participation and support.

In addition, innovative policies play a key role in promoting urban greening. Government financial input, improvement of regulations and standards, and promotion of public participation are important guarantees for achieving urban greening goals. Through policy guidance and incentives, more resources and forces can be mobilized to participate in urban greening, improving the implementation and sustainability of greening projects.

In the future, the development of urban greening should pay more attention to scientific planning, technological innovation, and public participation. Through interdisciplinary cooperation, combined with the application of modern technology, more effective solutions to the challenges faced by urban greening can be achieved, realizing more sustainable and aesthetically pleasing urban greening. At the same time, policy support and public participation are indispensable. Only with the joint efforts of all parties can urban greening develop in a more scientific, beautiful, and practical direction, making а greater contribution to achieving ecological balance and sustainable development in the United States.

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