

Research on the Synergistic Development of Ecological Governance and Rural Landscape in Suburban Small Watersheds

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ABSTRACT

This study investigates suburban small watersheds in the mountainous regions of northern Hubei through case analysis and field research, aiming to explore synergistic pathways between ecological governance and rural landscape construction. The findings reveal that integrating ecological restoration, cultural heritage preservation, and industrial integration can significantly enhance water quality, boost biodiversity, and stimulate rural tourism revenue growth. A trinity model of "ecology-industry-culture" is proposed to provide practical references for urban-rural integration and rural revitalization.

Keywords: Ecological governance; Rural landscape; Synergistic development; Cultural heritage; Industrial development

Suburban small watersheds, as critical transitional zones between urban and rural areas, possess significant ecological, economic, and social value. However, rapid urbanization has led to pressing challenges such as ecological degradation, industrial homogenization, and landscape fragmentation, hampering sustainable urban-rural development. Therefore, researching ecological governance and rural landscape construction in these areas is vital for improving environmental quality and advancing rural revitalization. Drawing on the "Ecosystem Service Value Theory" (Daily, 1997), this study contrasts domestic practices with the "U.S. TMDL Program". Through multi-case collaborative analysis, it addresses the gap in the ecological-industrial-cultural synergy mechanism.

1. Current Status of Ecological Governance in Suburban Small Watersheds

1.1 Analysis of Ecological Problems

Suburban small watersheds face four major anthropogenic ecological issues: Water Pollution: Domestic sewage, industrial effluents, and agricultural

non-point source pollution contribute to eutrophication and water quality degradation, threatening drinking water security and aquatic ecosystems. Soil Erosion: Overexploitation and vegetation destruction exacerbate soil erosion, leading to reduced soil fertility, river siltation, and heightened flood risks. Biodiversity Loss: Habitat fragmentation and environmental pollution diminish wildlife diversity and abundance, weakening ecosystem resilience. Landscape Fragmentation: Urban-rural infrastructure development fragments natural landscapes, disrupting ecological processes and reducing aesthetic value.

1.2 Existing Governance Measures and Effects

1.2.1 Existing Ecological Governance Measures

Ecological governance in suburban small watersheds includes engineering, biological, and management measures. Engineering measures involve: River regulation, such as dredging, bank protection, and ecological embankments, to improve flood control capacity and restore river ecosystems. Construction of sewage treatment plants and constructed wetlands to treat domestic and industrial wastewater, reducing

water pollution. Building terraces, check dams, and silt traps to control soil erosion and restore soil fertility. Biological measures include vegetation restoration (e.g., afforestation, returning farmland to forests/grasslands) to increase green coverage and ecological restoration (e.g., ecological floating beds, artificial fish nests) to rehabilitate aquatic ecosystems and enhance biodiversity. Management measures involve designating ecological protection red lines, implementing the river chief system, and strengthening environmental supervision.

1.2.2 Effect Analysis

On one hand, water quality has improved, soil erosion has been controlled, and ecosystems have recovered. For example, Xiaochang County adopted the Ecology-Oriented Development (EOD) model, closing 11 farms and rectifying 9 sewage outlets in the Yanjiahe River Basin, achieving 95% rural sewage treatment coverage. Villagers' awareness of ecological governance has increased, and public participation has improved. However, challenges remain: insufficient funding, low technological application, conflicts between governance and economic development ("over-development, under-protection"), and lack of long-term mechanisms to sustain results.

2. Current Status and Problem Analysis of Rural Landscape Construction

2.1 Current Status of Rural Landscape Construction

2.1.1 Achievements

Suburban small watersheds have made progress in rural landscape construction:

Improved rural environment: Village greening, beautification, and lighting projects have significantly transformed the appearance of many villages, enhancing living conditions.

Enhanced rural characteristics: Some areas have developed unique rural landscapes by leveraging local history, culture, and folklore, boosting their attractiveness and competitiveness.

Booming rural tourism: Beautiful landscapes have attracted tourists, boosting rural vitality and farmers'

income.

2.1.2 Existing Problems

Rural landscape construction faces several challenges: **Lack of uniqueness:** Blindly imitating urban styles while neglecting rural characteristics and culture has led to homogeneous rural landscapes, resulting in a "one-size-fits-all" appearance across villages. **Neglect of maintenance:** Focusing solely on construction while ignoring post-construction management has caused deteriorating facilities and poorly maintained environments. **Funding shortages:** Local financial constraints often hinder landscape construction due to insufficient investment in rural areas.

2.2 Cause Analysis

Rural landscape construction faces three core challenges:

Misunderstanding of landscape value: Viewed merely as beautification, ignoring ecological, cultural, and economic dimensions. **Lack of systematic planning:** Haphazard construction causes resource waste and landscape damage. **Ineffective coordination:** Fragmented efforts among departments reduce efficiency.

3. Models for Ecological Governance and Rural Landscape Construction in Suburban Small Watersheds

3.1 Caozhai Village: Integration of Ecological Clean River Basin Governance and Rural Landscape

3.1.1 Ecological Governance Measures and Effects

Caozhai Village, located in the southern part of Doushan Township, Xiaochang County, Hubei Province, features over 300 mu of water area and a network of rivers, ponds, and ditches surrounding the village. The village has adopted a number of effective measures in ecological governance and achieved remarkable results.

First of all, Caozhai Village has carried out a comprehensive rectification of small water bodies such as small ponds, ditches, canals and streams (rivers) in the rural fields. By improving water quality, water ecology and water environment, the ecological functions of these small water bodies have been effectively enhanced. This

effort enhanced the ecological functions of these micro-watersheds, transforming them into recreational spaces for villagers and laying the foundation for rural eco-tourism. Second, the village established a "joint task force for collaborative development" involving county-level departments and contracted units. Through extensive consultations and meetings, it gathered villagers' feedback to formulate detailed environmental improvement plans. A "three-governance" mechanism—combining institutional regulation, categorized organizational management, and professional team oversight—was implemented to ensure long-term sustainability of environmental initiatives. Currently, the village has achieved significant improvements: roads are wider, streetlights are brighter, infrastructure is modernized, and villagers' quality of life, happiness, and sense of security have been notably enhanced.

3.1.2 Characteristics and Experience of Rural Landscape Construction

Caozhai Village fully utilizes local resources and combines rural style and cultural characteristics to create landscapes. Around the central water system, scenic views such as "Xiangshui Pavilion" and "Hundred Year Old Cypress Trees" have been created, as well as the "Beautiful Little Jiangnan" landscape belt, which not only retains traditional charm but also adds modern atmosphere. Caozhai Village encourages villagers to participate in landscape construction, and through consultation and joint construction, creates a series of micro landscapes such as Lianxin Bridge, leisure pavilions, and village historical and cultural walls. These micro landscapes not only beautify the rural environment, but also enhance the cultural identity of villagers. Making villagers the main body of rural landscape construction enhances their sense of belonging and responsibility.

3.1.3 Synergistic Development Model of Ecological and Landscape

Caozhai Village closely integrates ecological governance with landscape creation. By improving the ecological environment and enhancing the quality of the landscape, it has promoted the development of rural tourism, bringing considerable economic benefits to the

village and achieving a deep integration of ecology and landscape. At the same time, relying on its beautiful ecological environment and unique landscape resources, the village has developed various industrial projects such as courtyard homestays, seasonal picking, and local specialty sales, which have increased villagers' income and promoted the diversified development of the village economy. This model of synergistic development between industry and ecological landscape has laid a solid foundation for the sustainable development of the village.

3.2 Yanjiahe: River Basin Governance Promotes Rural Landscape and Industrial Development

3.2.1 River Basin Governance Projects and Ecological Restoration

Yanjiahe River is located in Xiaochang County, Hubei Province, with a drainage area of 8.86 square kilometers. It is an important vegetable supply base in the urban area of Xiaochang and an important ecological node of the county's "Three Rivers and Six Banks". Through comprehensive measures such as source control and pollution interception, ecological restoration, etc., the environment of coastal villages and bays has been improved, eliminating multiple black and odorous water bodies, restoring aquatic vegetation, and increasing water area, which has fundamentally improved the water ecological environment of the Yanjiahe River Basin. In addition, in the ecological governance process of the Yanjiahe small watershed, attention was paid to the connection of the source water system and ecological water replenishment work. By establishing a "five party joint governance" mechanism (referring to county leadership, town responsibility, village main body, group maintenance, and household participation), rural production sewage treatment was strengthened, breeding farms in the watershed were dismantled, and sewage outlet remediation was completed to ensure the ecological flow of the entire watershed.

3.2.2 Rural Landscape Improvement and Tourism Development

The comprehensive improvement of the Yanjiahe small watershed not only improves the ecological environment, but also promotes the enhancement of rural

landscapes and tourism development.

The Yanjiahe River Basin boasts beautiful natural scenery and abundant cultural resources. Through the ecological environment oriented development model (EOD model), demonstration areas for rural revitalization have been constructed, and diversified formats such as smart water-saving agriculture, homestay health and wellness, cultural creativity, sports and leisure, and agricultural exhibitions have been planned and laid out. For example, the construction of popular attractions such as Xiaomenghong Ecological Tea Garden has attracted a large number of tourists to come for sightseeing and tourism, driving employment for 200 people and increasing per capita annual income by ¥15000. At the same time, the county pays attention to the improvement of rural infrastructure in the Yanjiahe small watershed, such as road hardening, greening and beautification, and public facility construction, providing tourists with a more convenient and comfortable tourism environment.

Relying on the ecological advantages of the Yanjiahe River Basin, we vigorously develop ecological agriculture and rural tourism industries, and achieve industrial transformation and upgrading through the deep integration of agriculture and tourism. On the one hand, the development of ecological agriculture has injected new vitality into the rural economy, such as the planting and promotion of high-quality agricultural products such as Taizi rice, which not only improves the income level of farmers but also enhances the ecological quality of rural areas. On the other hand, the rise of rural tourism industry has brought more popularity and business opportunities to the Yanjiahe River Basin, promoting the development of local catering, accommodation, transportation and other related industries. At the same time, the creation of ecological landscapes also provides strong support and guarantee for industrial development, such as the construction of ecological tea gardens, water parks and other scenic spots, which not only beautify the rural environment, but also provide tourists with rich tourism experiences. The positive interaction between industrial development and ecological landscape has injected lasting momentum into the comprehensive improvement of the

Yanjiahe small watershed.

3.3 Taoyuan Village: Landscape Creation and Cultural Integration Along the Stream

3.3.1 Stream Remediation and Landscape Engineering Construction

Taoyuan Village is located in a canyon between the Dabie Mountains and Tongbai Mountains, with unique natural scenery. In order to protect and utilize this natural resource, Taoyuan Village first carried out a comprehensive renovation of the village's streams, including cleaning up river garbage, repairing water systems, protecting water sources, etc., enhancing the natural beauty of the streams, providing clean domestic and irrigation water sources for villagers, ensuring their production and living needs, and effectively improving the water quality and ecological environment of the streams. Taoyuan Village has two major features: one is the stone houses, and the other is the persimmon trees. Therefore, multiple landscape nodes have been built along the stream, such as Taoyuan Gate Tower, Jade Emperor Tower, Water Wheel Square, etc., connecting the two distinctive local elements, not only beautifying the rural environment, but also enriching the tourist experience. During the construction process, emphasis was placed on the practicality and sustainability of landscape engineering. By using local materials and plants, construction and maintenance costs were reduced, while enhancing the local characteristics and vitality of the landscape.

3.3.2 Rural Landscape Features of Multicultural Integration

In the construction of rural landscapes, Taoyuan Village has deeply excavated the rich cultural resources of the local area, ingeniously integrating diverse cultures such as agricultural culture, old area red culture, and Guanzhai culture, forming a unique rural landscape feature.

Taoyuan Village not only protects ancient dwellings and stone houses, but also emphasizes the integration of modern functions. Through the restoration and renovation of the stone house, the ancient style has been preserved while meeting the needs of modern life. In terms of

courtyard layout, Taoyuan Village encourages villagers to use methods such as laying green stones on the ground and planting flowers and plants, which reflects the villagers' living customs and the primitive style of the countryside, while also adding a touch of modern life.

Taoyuan Village, relying on the cultural and historical resources of Wushengguan, combines the ancient village of Taoyuan with the Guanzhai culture, excavates the historical and cultural significance of the "Three Passes of Northern Chu", and forms a unique historical and cultural experience area that integrates military culture, Guanzhai culture, and village culture. By integrating Guanzhai culture with natural landscapes, Taoyuan Village not only enhances the cultural connotation of rural landscapes, but also provides tourists with rich tourism experiences.

3.3.3 Sustainable Development of Rural Landscape Driven by Culture

Culture plays a core driving role in the sustainable development of rural landscapes in Taoyuan Village. Taoyuan Village attaches great importance to the inheritance and protection of traditional folk culture, such as the restoration of Taoyuan Village's folk weddings, prayer activities, etc., and the establishment of folk handicraft workshops such as boiling wine, making vinegar, hanging noodles, and pottery. These cultural inheritance activities not only enrich the spiritual and cultural life of villagers, but also add unique cultural charm to the rural landscape. On the basis of protecting traditional culture, Taoyuan Village emphasizes cultural innovation and promotes the development of rural tourism industry. By creating interactive experience projects for handmade tribes, Taoyuan Academy, Shiwang Square and other rural leisure landscapes, a large number of tourists have been attracted to come for sightseeing and tourism. At the same time, Taoyuan Village also relies on characteristic agricultural products such as persimmons to develop ecological agriculture and rural tourism industries, forming a development model of "ecology+culture+tourism", and achieving sustainable development of rural landscapes. Strategic suggestions for ecological governance and rural landscape creation in suburban small watersheds.

4.Strategic Suggestions on Ecological Governance and Rural Landscape Sonstruction of Suburban Small Watersheds

4.1 Ecological Governance Strategy

4.1.1 Innovative Governance Technologies and Methods

Firstly, advanced ecological governance technologies such as intelligent monitoring technology and new materials for ecological restoration should be introduced to improve the accuracy and efficiency of governance Secondly, it is necessary to strengthen the integrated innovation of ecological governance technologies, integrate multiple technological means according to the characteristics and needs of different small watersheds, and form comprehensive governance plans. For example, in areas with severe soil erosion and fragile ecosystems, a combination of biological measures (such as afforestation, grass planting and slope protection) and engineering measures (such as building terraced fields and retaining walls) can be used, along with ecological restoration techniques such as soil improvement and vegetation reconstruction, to achieve comprehensive restoration and protection of the ecological environment in small flow areas. Finally, research and application demonstrations of ecological governance technologies should be carried out, demonstration bases should be established to showcase the application effects of advanced technologies and provide reference and guidance for other regions. Xiaochang County has established an ecological clean small watershed demonstration base in the upper section of Yanjia River, which has applied a series of advanced technologies such as rainwater collection and utilization technology, ecological wetland purification technology, and ecological slope protection technology. Through practical cases, the effectiveness and feasibility of these technologies in small watershed ecological governance have been demonstrated. Attracted government departments, research institutions, and enterprises from surrounding areas to visit and learn, promoting the promotion and application of advanced technologies.

4.1.2 Expansion of Funding Channels and

Management Strengthening

One is to increase government financial investment, including the ecological governance of suburban small watersheds in the government budget, and increase funding efforts. Simultaneously strive for national and provincial special funding support for ecological governance in key river basins. The second is to innovate investment and financing mechanisms, promote the government social capital cooperation (PPP) model, and attract social capital to participate in ecological governance. Issuing green bonds to raise funds for ecological governance. The third is to strengthen fund supervision, establish and improve the management system for fund use, and ensure the safe and efficient use of funds. Strengthen project performance evaluation and improve the efficiency of fund utilization.

4.1.3 Enhancement of Public Environmental Awareness and Participation

One is to strengthen the publicity and education of ecological protection in suburban small watersheds, through various forms such as holding environmental lectures, distributing promotional materials, and carrying out environmental protection activities, to raise public awareness of the importance of ecological governance and enhance public environmental awareness. The second is to establish a public participation mechanism to encourage public participation in the decision-making, implementation, and supervision process of ecological governance in small watersheds. The third is to establish a volunteer team and organize public participation in ecological protection activities, such as afforestation, river cleaning, environmental protection propaganda, etc., to form a good situation where the whole society participates in ecological governance together. The fourth is to give full play to the role of village rules and regulations, incorporate ecological environment protection into village rules and regulations, and guide villagers to consciously protect the ecological environment.

4.2 Rural Landscape Creation Strategy

4.2.1 Highlighting Regional Characteristics and Cultural Connotation

One is to deeply explore the natural and cultural

resources of rural areas, including unique terrain and landforms, local plants, traditional architectural styles, folk culture, historical stories, etc., and integrate these elements into landscape design to create rural landscapes with distinct regional characteristics. The second is to utilize the folk culture of rural areas, such as traditional handicrafts, folk art, festival activities, etc., to create landscape nodes with cultural experience, attract tourists to come and enjoy and participate, enrich the cultural life of rural areas, and enhance the attractiveness of rural landscapes.

4.2.2 Strengthening Ecological Protection and Landscape Planning

In the process of rural landscape construction, we adhere to the principle of ecological priority and integrate ecological protection throughout the entire process of landscape planning, design, and construction. Protect the natural ecosystems of rural areas, such as mountains, rivers, wetlands, etc., and avoid excessive development and destruction. Based on the natural conditions and ecological functions of rural areas, carry out scientific and reasonable landscape planning. Reasonably layout various landscape elements to form a good landscape pattern. Plan ecological corridors to connect different ecological patches, promote the migration and diffusion of organisms, and improve the connectivity of ecosystems. Set up ecological buffer zones on both sides of the river, plant aquatic plants, purify water quality, and protect the ecological environment of the riverbank. Promote eco-friendly landscape construction technologies and materials to reduce negative impacts on the environment. Using permeable paving materials to increase rainwater infiltration and reduce surface runoff; Utilize clean energy sources such as solar and wind power to provide energy support for landscape facilities; Using local native plants for greening, improving plant adaptability and survival rate, reducing maintenance costs, and promoting biodiversity conservation.

4.2.3 Improving Landscape Management and Maintenance Mechanisms

Establish and improve a long-term mechanism for rural landscape management, clarify the division

of responsibilities among departments, and strengthen coordination and cooperation among departments. Develop a comprehensive rural landscape management system and standards, strictly manage the construction, maintenance, and use of landscape facilities, and ensure the quality and effectiveness of rural landscapes.

Strengthen the cultivation and introduction of talents in rural landscape management, and improve the professional quality and management level of the management team. Regularly organize management personnel to participate in training and learning exchange activities, understand the latest landscape management concepts and technical methods, and enhance management capabilities. Attracting professional landscape management talents to work in rural areas and injecting new vitality into rural landscape management.

Encourage villagers to participate in the management and maintenance of rural landscapes, and enhance their environmental awareness and participation enthusiasm. Establish a mechanism for village participation, such as establishing village regulations and agreements, setting up village supervision groups, and conducting volunteer activities, to encourage villagers to consciously participate in the daily maintenance of landscape facilities, environmental sanitation improvement, and other work. Through publicity and education, enhance villagers' awareness of the value of rural landscapes, and strengthen their awareness and sense of responsibility for protecting rural landscapes.

4.3 Coordinated Development Strategy of Ecological Governance and Landscape Creation

4.3.1 Establishment of a Unified Planning and Management Mechanism

The unified planning and collaborative management of ecological governance and landscape creation are crucial. One is to incorporate the ecological governance of small watersheds and the creation of rural landscapes into regional development plans, establish unified goals and indicator systems, and clarify specific requirements for ecological protection, industrial development, landscape construction, and other aspects. The second is to establish a collaborative working mechanism composed

of departments such as water conservancy, agriculture, forestry, and tourism, clarify the responsibilities of each department, strengthen information sharing and resource integration, and form a working force. The third is to encourage villagers to participate in planning, project implementation, and post management, improve their ecological awareness and participation, and create a good atmosphere of co construction, co governance, and sharing.

4.3.2 Promotion of the Integration of Ecological Industries and Rural Tourism

The integrated development of ecological industry and rural tourism is an important way to achieve sustainable development of suburban small watersheds. Encourage the development of ecological industries such as ecological agriculture, ecological forestry, and ecological fisheries, promote green planting and breeding technologies, reduce the use of fertilizers and pesticides, produce green and organic agricultural products, and increase the added value of agricultural products. In the small watershed area of Yanjiahe River, the development of organic vegetable planting industry, through the use of green prevention and control technology to prevent and control pests and diseases, has produced organic vegetables that are highly popular in the market, driving an average income increase of more than $\square 15000$ per capita for surrounding residents. Combining the ecological industry with rural tourism to create an ecological tourism project that integrates picking, sightseeing, experience, and science popularization. In the small watershed of Caojiahe River in Xiaochang, relying on the abundant tea resources in the area, an ecological tea industry belt has been built, and characteristic projects such as Xiaomenghong Ecological Sightseeing Tea Garden, educated youth cultural homestay, Xiaolongwan Camping and Barbecue, and Wulonghu Water Park have been launched, attracting a large number of urban residents to experience and driving the development of local rural tourism. Strengthen the construction of rural tourism infrastructure, improve service facilities such as catering, accommodation, and transportation, enhance the level of rural tourism services, and attract more tourists.

4.3.3 Strengthening Policy Support and Guarantee System Construction

Firstly, it is necessary to increase the investment of fiscal funds in ecological governance of small watersheds and rural landscape construction, encourage the participation of gentry capital, and explore models such as government and social capital (especially gentry capital) cooperation (PPP). Secondly, it is necessary to formulate and improve relevant laws and regulations, clarify the responsibilities and obligations of all parties, and strengthen the supervision of small watershed ecological governance and rural landscape construction. Furthermore, it is necessary to strengthen the research and promotion of ecological governance and landscape construction technologies, introduce advanced technologies and equipment, and improve the efficiency of governance and construction. Finally, it is necessary to mobilize villagers to consciously participate in ecological governance, landscape construction, and management. The wisdom of the working people is infinite, and local villagers are the most familiar with the history and current situation of the village, as well as the current needs.

5 Conclusion and Prospect

This study focuses on the ecological governance and rural landscape construction of suburban small watersheds. Taking the suburban small watersheds in the mountainous area of northern Hubei as an example, the ecological governance and rural landscape construction of Caozhai Village, Taoyuan Village, Yanjiahe small watershed, etc. effectively improve the ecological environment quality of suburban small watersheds, create unique rural landscapes, and achieve coordinated development of ecology, economy, and society. The limitation of this study is that the case is focused on the mountainous area of northern Hubei, and it needs to be expanded to different geographical units such as plains and coasts in the future. Suggest exploring the application of remote sensing and AI technology in ecological monitoring of small watersheds, Dynamically evaluate the effectiveness of vegetation restoration, water purification, etc. The ecological governance

of suburban small watersheds and the creation of rural landscapes is a complex and dynamic process that requires interdisciplinary and multidisciplinary collaboration. In the future, attention should be paid to the combination of theory and practice, further strengthening the integration of ecology and landscape, constructing a suburban small watershed ecological landscape system with complete ecological functions and beautiful and pleasant landscapes, promoting higher quality sustainable development in suburban areas, and injecting new vitality into rural revitalization and ecological civilization construction.

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