Study on the Ecological Restoration of the Urban Remnant Patches in the Process of Rapid Urbanization

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Keywords: The present situation and thinking, The ecological restoration, The urban remaining patches, The rapid urbanization.

Abstract. The rapid urbanization led to a large number of remnant plaques. It plays an important role to restore the urban residual plaques for the resolution of contradiction between resource demand and limited environmental carrying capacity and the series of problems of urban construction such as increasing environment, urban image, urban vitality and economic development, etc.

Based on the study of time and content, urban wildlife habitat and biodiversity conservation, basic theory and practices of urban sustainability and ecological design standards, the progress of ecological restoration of patch was discussed in domestic urban areas. The foreign dynamic progress was also discussed from four aspects of content: practice of patch, patch fragmentation and disturbance, comprehensive ecological service function, sociology of restoration of public participation, etc. The existing problems of the study were analyzed, which included insufficient understanding, limitations of research content, lack of systematic theory and technical guidance, research deficiency of the key factor of human. And the connotation and denotation were defined. A system method of urban ecological restoration was put forward: a method of Artificial Ecological System, as an artificial ecological system based on artificial positive interference on urban residual plaque, which is a positive response to the rapid rebalance and sustainable development of urban ecosystem, the artificial ecological system.

Introduction

The rapid development of industrialization and urbanization in China and the sprawl pattern of urban construction, which leads to the increasing contradiction between limited natural resources and human demand for resources.

As a result, the original patches were extremely fragmented and even disappeared in the urbanization region. It was emphasized especially for some natural patches. These remnant patches play an important role in maintaining urban biodiversity, conservation of native species, ecological services, utilizing land resources, inheritance of local characteristics, improving the ecological environment and so on. It is necessary and urgent for sustainable urban to restore the remnant patches in the process of urbanization.

The Domestic Dynamic Development of Urban Remnant Patch

The urban “double repair” policy of the Ministry of construction in 2016, which means eco-restoration and urban repair, 2016 International Symposium on wetland conservation and
sustainable utilization in Nanjing, Jiangsu, the urban ecological civilization taken as a national strategic by China's eighteenth Party Congress of 2013, The presentation concept of “Sponge city” in 2012, all of which promoted the study of urban remnant plaque. Generally speaking, in China, the research on urban remnant patches was mainly studied in the following several aspects.

**Initial Research Time and Content**

The research on the restoration of urban remnant patches was relatively late. It started from the beginning of the 21st century. The research was mainly focused on the introduction of foreign related research and localization, proposing and recommending related ideas. There was no basic theory research, norms and standards, especially, the restoration of urban remnant patches based on the ecological engineering just started in recent years, and it was mainly in agriculture fields and urban green land.

**Study on Urbanization and Biodiversity Conservation**

Yu Kongjian believed that the protection of native species and habitat diversity was conducive to the construction of urban biodiversity [1]. Wang Xian Pu studied the effects of urbanization on biodiversity, He suggested that urbanization had a direct impact on urban biodiversity - the disappearance of species, and the indirect impact of habitat destruction [2]. From the viewpoint of regional plant communities, Ding Sheng Yan studied the value of urban remnant plants and the biodiversity conservation [3]. Based on the urban location of countryside, suburbs, downtown, Li Jun sheng et al., explored the effects of urbanization on biodiversity [4].

**Basic theory and Practice of Sustainable and Ecological Design Standards**

Huang Leichang et al. put forward the standard of ecological thinking for sustainable and ecological design, which included three sides: the protection of the natural environment, the inheritance of regional context and the control of economic cost. They also studied on technology and theory of eco-model [5-6]. Yu Kongjian constructed urban ecological basic infrastructure network by the method of landscape security pattern [7]. In practice, the construction of Zhongshan Qijiang Park, the revival of Guangdong Zhongshan City Yue Zhong ship plant, was the representative of the protection and regeneration of industrial wasteland with the idea of ecological restoration and urban renewal.

**The Foreign Dynamic Development of Urban Remnant Patch**

Foreign Studies on Urban Remnant patches were mainly from 1970s, and the restoration of industrial wasteland, the overall protection and sustainable utilization of the remaining natural patches in the process of urbanization and industrialization, which were taken as the main research contents. In recent years, the concrete foreign studies on restoration of the remnant patches were mainly focus on several aspects such as the practice of urban remnant patch, fragmentation of urban remnant patches and analysis of artificial disturbance, analysis of eco-value and the society of public participation, etc.

**Study on the Practice of the Urban Remaining Patches**

The biological habitat protection for the German Dusseldorf city was planned in 1990, and the urban habitat network was design. The transformation of abandoned Air Force Base with severely degraded natural system, the Canada’s Downsview Park, in 1996. The England Eden Project in 2001, repair of giant clay collection site. The BP oil company ruins park of Australian: Regeneration of the waste oil depot, 2005. In 2006, the restoration and regeneration of the largest industrial pollution site of the closed Bethlehem Steel Plant in Southern Bethlehem.

**Study on the Fragmentation of Urban Remnant Patches and the Analysis of Artificial Disturbance**

In 2004, by the investigation of 71 samples of 7 aspects including interference types, surrounding land and so on, Renae N. Stenhouse studied on the remnant native vegetation patches, in Perth of Australia,
and the research showed that the inverse relationship between patch fragmentation and urbanization intensity. Stevens S M et al. studied on the habitat fragmentation of wild animal. Jokimaki J et al. studied on the vegetation evolution process responding to habitat fragmentation.

In fact, the cases of restoration of wasted industrial sites or wetlands were a kind of the humans’ corresponding disturbance to the remnant patch, such as the North Duisburg Landscape Park in Ruhr Area of Germany, the BP Oil Company ruins park of Australian, and so on. And that suggested that there were two kinds of disturbance according to the intensity of it, one is virtuous, another was vicious.

**Study on the Eco-value of the Urban Remnant Patch**

Lin Robinson et al thought the remnant natural vegetation had a higher habitat value than the artificial one. Parsons H et al., studied on the eco-service function of native plants, the value of urban remnant natural patches as the habitat of birds. Erkip F B studied on leisure services of the Ankara Park, the capital of Turkey in 1997. David Schmitt et al. researched the value of cultural landscape of the remnant natural forest land patches in the eastern of North America.

**The Sociology of Restoration of Urban Remnant Patch -- Public Participation**

Public participation comes from political policy. And it was introduced to many subjects as a solution method for the problems referring to public affairs. As to the urban remnant patch, it is still a good way. Jonathan thought public participation was a green and cheap approach. The Congress of the United States regarded public participation as an important supplement to environmental administration. Thomas Webler and Seth Tuler evaluated the effect of public participation in the process of forest management decision making, and to judge the criteria of good participation process. Margaret A. House studied on the public participation in water resources management.

**Discussion**

**Analysis on the Research Status of Urban Residual Plaque**

**Does Not Systematically Put Forward the Concept of Urban Residual Plaque as an Explicitly Urban Problem.** Reviewing the domestic and international research on Urban Remnant patches, in general, there is no awareness of urban remnant patches as an urban issue. This was mainly due to the lack of understanding of the urban remaining patches, with a fuzzy connotation and extension of this concept, which led to no systemic definition of the urban patch.

**Limitations of Research Contents.** The study of urban remnant patches was mostly confined to the remaining natural plant communities, industrial wasteland, the remaining farmland, wildlife habitat and so on. A few started to think about the methods of eco-engineering and eco-thinking.

**Lack of Systematic Theoretical Guidance and Technical Support for Ecological Restoration of Urban Remnant Patch.** City as an artificial ecosystem, ecological restoration of urban problems requires a systematic theoretical and technical system to guide and support. The current research was to extract the needed theory from ecology. Therefore, it was not systematic and holistic. At the same time, there was no clear technical system for the urban remnant patch to ensure the implementation of the restoration of residual plaque. The restoration methods were relatively monotonous, the main means of regeneration and utilization of community, habitat and waste land were used in practice. It was urgent to construct a systemic theory and technology.

**Ignore the Main Factors of Urban Remnant Patch Repair: The Study of Human Being.** The formation and repair of urban remnant patches, which ultimately was caused by the disturbance of the important factor of human. Therefore, the study only focus on the results was not comprehensive, although there were some cases of urbanization and disturbances. It was also the representation of ignoring of the key factors, which was not benefit to the restoration of urban residual plaque. As a matter of fact, not only the formation of residual plaque was caused by human being’s participation,
but also this important factor was much more needed to participate in the reparation of the urban residual plaque – needing their positive interference to accomplish the process.

Urban Remnant Patch: A Concept That Must Be Clearly Presented and Defined

**Definition of Urban Remnant Patch.** The urban remnant patches are all kinds of residual patches in the process of urbanization, the incomplete or broken plaques, which were strongly disturbed by human activity. The development and evolution of urban remnant patches were influenced dominantly by human behavior. The ability of self repair of urban remnant patches was weak, and it was subject to the manner and intensity of human activities. The research contents of urban remnant patches included the characteristics, types, causes of formation, evolution process, theory and methods of ecological restoration, the theory and method of ecological restoration was the key point.

**Analysis of the evolution process of remnant patches.** There were about two possible evolution process and trends, one started from healthy and complete plaque, through the series evolution of fracture and repair, ended as a new healthy and complete plaque. Another one began the process from secondary plaque, having the same middle stage evolution process with the first one, took a newly added stable plaque as the termination.

**Thinking on the Restoration of the Remaining Patches — An Ecological Method of Artificial Ecosystem**

**Ecological Restoration Method of Artificial Ecosystem.** The restoration method of artificial ecosystem ecology was present based on the cause of formation, evolution process and the human being, the key factor of the repair of urban remnant plaques, whose activities in the process of urban construction. Ecological restoration of artificial ecosystem ecology was a fusion of urban planning, ecology, landscape design, engineering, aesthetics, art and design and many other disciplines.

**Three scales and three levels.** It was based on the urban problems, the large data of multi factors, such as urban remnant patches, human activities, and urban nature and so on. It took the urban ecosystem rebalance and sustainable development as the macro control objectives, took the construction and supervision of patch ecological restoration with the participation of the public and experts as Meso process management, took ecological engineering construction as the means of micro repair. And the effective restoration included three scales of macro, meso and micro scale, three levels of the planning control, process management, technical support, which was the restoration method of artificial ecosystem ecology, to repair the urban residual plaque with the dimension of urban problems.

**Acknowledgement**

The authors want to thank the anonymous reviewers for their helpful comments and suggestions. The authors are grateful to the support of the National Natural Science Foundation of China (Grant no. 31570701); and the National Natural Science Foundation of China (Grant no. 31270747), and this is also supported by 2016 Liaoning Provincial Social Science Fund Project (Grant no. L16BJY003). This research was also financially supported by the Liaoning Province basic scientific research business fund in 2016 (Grant no.2016J009), the same thanks to them.

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