

# The Reconstruction of Regional Ecological Planning Value by Combining Conjugate Ecological Concept and Coupled InVEST Model

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**Abstract:** With the advancement of urbanization in modern society, the construction and development of cities has had an inestimable negative impact on the basic function of the natural system, and the excessive concentration of resources has also brought unprecedented pressure to the urban infrastructure. In the traditional urban design, city and ecology is often split and separate, at the end of the 20th century, mainly Europe, the United States, western countries saw the ecological potential of urban infrastructure, began to explore the combination of New York development and nature protection planning and design method, ecological planning and construction related theory and practice conjugate ecological concept and coupling InVEST model arises at the historic moment. Ecological planning and construction are different from the previous theory of environmental protection. Ecological planning and construction recognize human needs for society and focus on the combination of ecological protection and development and artificial infrastructure.

**Keywords:** Ecological Planning; Conjugated Ecological Concept; InVEST Model; Ecological Security

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## Introduction

With the advancement of urbanization in modern society, the construction and development of cities has had an inestimable negative impact on the basic function of the natural system, and the excessive concentration of resources has also brought unprecedented pressure to the urban infrastructure. In the traditional urban design, nature and infrastructure is often split and separate, at the end of the 20th century, mainly in Europe, the United States of western countries saw the ecological potential of urban infrastructure, began to explore an urban development and natural protection of planning and design methods, ecological planning and construction of related theory and practice arises at the historic moment. Ecological planning and construction are different from the previous theory of environmental protection. Ecological planning and construction recognize human needs for society and focus on the combination of ecological protection and development and artificial infrastructure.

## 1. Methods and systems of ecological planning and construction

Establishing requirements and design goals is the first step in ecological infrastructure planning. First of all, the purpose and focus of the planned ecological infrastructure should be clearly defined, such as water conservation and restoration, rural and agricultural landscapes, biodiversity conservation, and so on. After clarifying the design objectives and study types, the second step is to collect and process the attribute data related to the ecological infrastructure. Common ecological infrastructure-related attribute data include: historical and meteorological data, hydrological and geological data, aerial map or satellite images, cultural and socio-economic data, related geographical characteristics, related photos and text

descriptions. Feedback and evaluation are the steps related to the success of the whole plan, but they are often the most difficult to control, without a fixed pattern and order. The planning results of ecological infrastructure programs can be assessed by feedback and evaluation, and the differences between different schemes should be compared for decision makers to choose. In the planning stage, the focus is often reflected in the attention and attitudes of various interest representatives, such as the city Park committee's attention to open green space, water conservancy department on flood and river, and cultural departments on heritage, etc. The essence of planning is to make the optimal scheme and planning on the premise of coordinating the interests of various departments.

## **1.1 Conjugated ecological concept**

The ecological essence of urban problems is the imbalance of the systematic relationship between man and nature, the retention and exhaustion of resource metabolism on time and space scale, the fragmentation and fragmentation of system coupling in structure and functional relationship, the shortcomings of social behavior in economic and ecological, local and overall relationship, and the defect of regulatory mechanism. Conjugate refers to the opposite sides of the contradiction, synergistic symbiosis. The concept of conjugation is used in ecology and refers to the balance between social service and ecological service, the balance of economic production and natural production, and the coordination of temporal correlation and spatial correlation. Conjugate ecological theory regulates the development, utilization, protection and restoration of the human ecological support system from the five aspects of time, space, quantity, structure and sequence, so that the structure, pattern, process and function of the composite ecosystem can operate efficiently, harmoniously and continuously.

## **1.2 The InVEST Model Theory**

InVEST model (Integrated Valuation of Ecosystem Services and Trade-offs) is fully called "Comprehensive Evaluation and tradeoff Transaction Model". The original purpose of this model is to quantify the ecosystem service function in a certain area and show the results on the floor plan map, so as to improve the scientific efficiency of human decision-making on natural resources. The InVEST model defines how changes in ecosystem structure and function may affect the flow and value of terrestrial or seascape ecosystem services. These models consider both the service supply and the location and activities of people benefiting from the service. In recent years, with the deepening of the research on ecosystem services gradually and the continuous development of model technology, InVEST models are particularly widely used due to their outstanding spatial analysis function and wide applicability.

## **2. Analysis and construction of -- Area**

With the rapid advancement of urbanization, people's combined planning of the city and the landscape can be summarized into two ways: one is to introduce the landscape into the city, and the other is to integrate the city's expansion into the surrounding landscape, which is also the source of Howard's rural urban thought. Ecological infrastructure planning on the urban scale also mainly revolves around sending two types, or a combination of two types. Through the theoretical basis of landscape ecology, delimit and analyze the land scope with key significance, and establish the landscape safety-based pattern analysis to ensure that the minimum damage of land development to nature is achieved. Landscape safety pattern is a planning way to "give priority to no construction" in urban development by delimiting the areas with high ecological value and protecting them in nature. And ecological infrastructure in the interstate and even within the territory, the most commonly used is as the assessment basis of landscape security pattern.

### **2.1 Planning of large-scale ecological infrastructure**

In the 1990s, with the popularization of landscape ecology and GIS technology, larger regional scale data acquisition

became possible, and interest began in the integrated utilization mechanisms of sustainable development models. Ecologists and urban planners are also coming to realize that it is not enough to isolate natural areas and protect them, and that ecological infrastructure, as a means of protecting natural resources and biodiversity, also needs research at a larger regional and landscape scale. GIS has a powerful information collection and collation function, providing a large number of basic information for geospatial analysis, including the superimposed layer, buffer zone, the best path development and analysis, etc. As urban ecological infrastructure planning expands to a broader perspective and field, GIS plays an important role in large-scale spatial planning and analysis.

## **2.2 The G I A evaluation method and its practice**

In this context, the first design of integrated ecological foundation planning appeared in Maryland. In 1990, Maryland launched an interstate ecological planning project for Yuanyuan Road, which laid the stage for ecological infrastructure as a tool for ecological analysis and evaluation methods in the interstate scope. In the Green Map plan, the ecological infrastructure in Maryland is classified and identified through the multi-layer superposition of GIS and spatial data, so as to obtain the evaluation method developed by the analysis of the spatial pattern of ecological infrastructure. GIA evaluation system, landscape ecology and biological ecology as the theoretical basis, using GIS to the state ecological network nodes, ecological corridor, edge and analysis, determine the indicators on the regional ecological sensitivity level and ecological value, to determine the ecological importance in urban development, and data output GIA evaluation results, state all land ecological protection priority, as an important basis for state planning and land development.

## **3. Mesoscale -- ecological infrastructure serves as a way to build an urban ecological network**

Ecological infrastructure planning inherits the idea of Olmsted's "park system": protecting and connecting the green and open space in cities. At the same time, the landscape of urban ecological infrastructure becomes a starting point, covering a series of transformation measures such as ecological rainwater management, low-impact traffic, and urban waterfront restoration. The ultimate goal is to create an ecological, healthy and humanized open space system at the level of urban ecological infrastructure, and to provide basic services and environmental improvement to the city to the large extent.

## **4. Micro-scale -- ecological planning and construction are combined with urban landscape construction**

In the post-industrial era, with the change of industrial mode in cities, western cities generally experienced the process from large-scale suburbanization to urban tun and rejuvenation. Due to the improvement of the highway system and the popularization of cars, the people represented by the middle class have gradually moved out to the outskirts of the city for a better living environment. Many once prosperous urban Zhongtun, districts began to show a trend of atrophy, urban Zhongtun, night has become a wandering gathering and high incidence of crime areas. To explore the essential reason of the shrinkage of urban tun, the difference of environment and the lack of ecological infrastructure. In recent years, the state has taken measures to carry out large-scale urban rejuvenation projects, and one of the entry points is the planning and construction of urban ecological infrastructure. In the process of planning of ecological infrastructure, the overall open space of the city is analyzed from the macro scope first, and the distribution of green space is carried out according to the principle of equal use, so as to maximize the accessibility of green space to all groups. Urban open Spaces, park green Spaces, greenways and urban slow traffic systems included in the ecological infrastructure all provide places for residents to exercise

and help them improve their physical and mental health.

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