

## 摘要

台灣屬於海島型國家，海岸涵蓋範圍相當大，絕大部分的開發行為皆直接或間接與海岸有關。在倡導經濟與環保並重的口號下，海岸資源的保育與土地開發間的兩難爭議勢所難免。而海岸環境之發展，除了必須兼顧水利工程技術及經濟功能價值之外，對於生態環境、景觀人文與區域發展等層面之影響，亦需進行適當的評估，以作為政策研擬時決策分析之依據。此外，海岸地區環境多變，不確定因素多，應用生態規劃法、多準則決策法，以及灰色系統及模糊理論來評估土地開發與管理政策，將更易於尋得合理有效之永續發展策略。然而，目前對於海岸環境規劃方面的研究，多在海岸的功能價值上有所著墨，更進一步的研究則是對於政府的管理態度及目前海岸地區的發展現況進行定性的描述和土地使用適宜性分析，對於土地開發方式的評估及土地使用類別的量化計算較少觸及。

本文主要為一方法論的應用研究，將以生態規劃理論為基礎，發展出一套完整的海岸環境規劃與評估體系，系統將涵蓋績效指標的擷取、評估面的研究及規劃面的分析。為解決海岸敏感地區資訊缺乏、評估系統代表性不足、規劃系統操作困難的問題，研究中將具有模糊語意尺度的灰色及模糊理論導入，利用群體認知的模糊評比，減少個人模糊語意尺度所帶來的主觀差異，以使整個海岸環境管理與資源利用評估結果，更能夠接近真實世界中的環境現象。

在評估面，將根據生態規劃理論選擇生態環境條件（避免對生態物種的影響、利於生態環境的維護、提升環境污染控制能力）、自然環境條件（減少環境資源的破壞、提升自然復育能力、增加土地的使用價值）及人文環境條件（減少公共建設的投入、促進地區的發展、加強社會價值觀的認同）三類指標建立海岸環境土地利用發展潛力準則體系，並應用模糊多準則評估的方法，解決環境發展中多層級、多屬性的評估問題。

在規劃面，則在生態保育與經濟發展並重的前提下，將生態保育、水質污染、景觀價值及經濟功能四項目標函數，利用妥協規劃法求得非劣解，以達到環境資源平衡利用的目標，並以敏感度分析瞭解不同環境變數對土地利用的影響程度，以利未來海岸地區環境分類評估量化及規劃管制工具之建立。

為此，本文將以涵蓋香山濕地的新竹市海岸地區作為研究案例，分別進行各面向模式建立後之實證研究，以提供決策者進行海岸環境資源規劃時之參考。研究結果在績效準則的擷取、土地利用的發展優勢排序及土地使用面積的最佳化安排上皆有顯著的成效，可以為台灣海岸環境管理與資源利用提出適當的建議。

**關鍵詞：**海岸環境、濕地、生態規劃、多準則決策、模糊理論

## **Abstract**

Taiwan is comprised of a number of islands. Most developments in Taiwan are, to some degree, related to the coastline. Given the guidelines for economic development and environmental protection, conflict between coastal resource preservation and coastal land development is inevitable. The development of coastal environments, in addition to considering techniques for hydraulic engineering and economic benefits, should also effectively evaluate the impacts of development on the environment, landscape, and regional development, thereby providing a reference for policy decisions. Moreover, given the unstable characteristics of coastal environments, the concepts of ecological planning, multiple criteria decision-making, grey system theory, and fuzzy theory can be adopted when evaluating land development and management policy, enhancing the ease with which one can identify reasonable and effective strategies for sustainable development. However, most studies of coastal environment planning are primarily related to the value of the coastal areas, with further studies elaborating on qualitative descriptions and applying land use suitability analysis to the managerial measure of coastal development. Quantitative investigations of land development and land use are rarely pursued.

This study applies analytical methodology based on ecological planning theories to generate a comprehensive system for planning and evaluating coastal environments. This proposed methodology comprises the gathering of managerial criteria, multiple criteria evaluation, and multiple objective programming. To overcome problems of a lack of data due to the geopolitically sensitivity of coastal areas, insufficient representation of criteria and the technical problem of the evaluation, the concepts of a fuzzy semantic scale, and grey system and fuzzy theories are introduced. The fuzzy evaluation by professional collective cognition is utilized to decrease the differences in subjective resulting from individuals. Overall, assessment results for management of coastal environments and resource utilization can address real-world environmental phenomena.

Ecological planning theories are utilized to determine ecological and environmental conditions, physical environmental conditions, and socio-cultural environmental conditions. These three categories are adopted as the criteria for evaluating the potential of coastal land use and development. Fuzzy multiple criteria evaluation are applied to the evaluative system of multiple hierarchy.

Given the premise of striking a balance between ecological conservation and economic development, the four goals—ecological conservation, water pollution prevention, landscape and economic benefits—are adopted as four functions, whereas the solution, obtained by compromise programming method, will be a nondominated-solution, thereby achieving a balanced utilization of environmental resources. The impacts of land use are assessed using different environmental factors in sensitivity analysis, and this data then serves as reference for future quantitative study of coastal environment categorization and to establish a tool for monitoring coastal planning.

The coastal area in Hsin Chu, including the Hsiang Shan Wetland, is adopted as an example for the empirical study, with the aim of providing a reference for policy decision makers when planning coastal development. Finally, this dissertation illustrates the applicability of the comprehensive system in the dominance of land use and the optimization of land use development, allow the data to serve as an appropriate reference

for management and utilization of environmental resources along coastal Taiwan.

**KeyWords:** Coastal Environment, Wetland, Ecological Planning, Multiple Criteria Decision Making, Fuzzy Theory