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集水區環境評析方法及其應用於生態工法規劃之研究

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摘　　要　近年來生態復育的觀念逐漸受到重視，國內對於生態工法的施作要求日益增加。有鑑於此，本研究根據集水區內之自然環境、生態環境以及社會經濟環境等層面，配合生態工法之施作條件，及休閒遊憩之附加價值，建立一生態工法施作集水區之評估體系，依此評估體系評選施作生態工法之集水區優先順序，施以生態復育之工作，以維護自然生態環境，同時達到提升當地休閒遊憩之集水區經營目標。

本研究首先透過效度分析問卷之方式，確認生態工法優先施作集水區評估體系；其次採用多評準決策技術（multi-criteria decision making, MCDM）中之分析階層程序法（analytic hierarchy process, AHP），針對不同領域之專家學者進行評選因子之權重分析。最後以實際案例，透過現地調查方式及地理資訊系統（geographic information systems, GIS）之空間資訊分析能力，建立集水區之評選資料，進一步利用偏好序列結構法（PROMETHEE）進行集水區評選之排序，並探討不同領域之專家學者，其排序結果之差異性。

爲進一步探討評選因子之權重分配對排序結果之影響，故對評選架構之「自然環境」、「生態環境」以及「社會經濟環境」等三類別進行敏感度分析，透過三者權重分配之改變對評選結果之影響進行討論。並於實證分析中，採用另一種多評準分析方法-EVAMIX 法進行計算排序，並比較不同分析方法對評選結果之影響。使用 PROMETHEE 法與使用 EVAMIX 法所得的評選結果，除業界有些微改變外其餘幾乎完全相同。由此可知，在相同的權重分配以及相同的評準值下，使用不同的多評準決策方法並沒有對評選結果產生影響。最後，本研究於評選架構中選取部分重要因子以建立簡化模式，並分析其適用性及實用性。在本模式下簡化模式與 EVAMIX 法之結果差別僅在一個順位，具有一定程度之精度。因此在一般不要求高精確性的決策上，簡化模式應足以作爲決策之依據，以達到迅速、簡便之目的。

關鍵詞：生態工法、多評準決策、地理資訊系統、分析階層程序法、偏好序列結構法、敏感度分析、混合資料評估法。

A Study of Watershed Environmental Assessment Model and Its Application to Ecological Engineering Planning

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ABSTRACT　In Taiwan, the demand on the implementation of the ecological engineering methods is increasing due to the growing appreciation on concept of ecological restoration. Therefore, this study proposed an assessment model to

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identify the watershed where is appropriate for ecological engineering based on the natural, ecological, and social-economic environment in watershed, requirements of the ecological engineering methods, and the potential value for tour and recreation. With the aid from the model, the priorities of the candidate watersheds for applying ecological engineering can be designated to achieve the objectives of watershed management, including environment protection, disaster mitigation, and recreation promotion.

The validity analysis questionnaires were first distributed and analyzed to establish the assessment system, the analytic hierarchy process (AHP) of multiple criteria decision making (MCDM) was then applied to analysis the weights of the criteria in the system. With data collected from field investigations and analysis results of geographic information system (GIS), the PROMETHEE method was operated to conclude the priorities of the watersheds for the expert groups of different background. To understand the impacts of changing weights of the factors, the sensitivity analyses were applied to the three categories of assessment criteria. Another method named EVAMIX was maneuvered to demonstrate the viability of the system. Finally, a simplified model was introduced by selecting several important factors from original system for the preliminary stage of planning.

Key Words: ecological engineering, multiple criteria decision making, geographic information system, analytic hierarchy process, PROMETHEE, sensitivity analysis, EVAMIX.