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A Multi-Objective Decision Making Model for Biodiversity Conservation and Planning: Exploring the Concept of Interdependency

Authors : M. Mohan, J. P. Roise, G. P. Catts

Abstract : Despite living in an era where conservation zones are de-facto the central element in any sustainable wildlife management strategy, we still find ourselves grappling with several pareto-optimal situations regarding resource allocation and area distribution for the same. In this paper, a multi-objective decision making (MODM) model is presented to answer the question of whether or not we can establish mutual relationships between these contradicting objectives. For our study, we considered a Red-cockaded woodpecker (Picoides borealis) habitat conservation scenario in the coastal plain of North Carolina, USA. Red-cockaded woodpecker (RCW) is a non-migratory territorial bird that excavates cavities in living pine trees for roosting and nesting. The RCW groups nest in an aggregation of cavity trees called 'cluster' and for our model we use the number of clusters to be established as a measure of evaluating the size of conservation zone required. The case study is formulated as a linear programming problem and the objective function optimises the Red-cockaded woodpecker clusters, carbon retention rate, biofuel, public safety and Net Present Value (NPV) of the forest. We studied the variation of individual objectives with respect to the amount of area available and plotted a two dimensional dynamic graph after establishing interrelations between the objectives. We further explore the concept of interdependency by integrating the MODM model with GIS, and derive a raster file representing carbon distribution from the existing forest dataset. Model results demonstrate the applicability of interdependency from both linear and spatial perspectives, and suggest that this approach holds immense potential for enhancing environmental investment decision making in future.

Keywords : conservation, interdependency, multi-objective decision making, red-cockaded woodpecker
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