Multi-Criteria and Multi-Objectives based Land Use Planning in the Jaffna Peninsula, Sri Lanka

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ABSTRACT. Land-use planning is the systematic assessment of land resources, alternatives for land use and economic and social conditions in order to select and adopt the best land-use options. It is an essential activity in any region, because the demands for different land uses usually exceed the available resources. The aim of this research is to explore sustainable land use options through multi-criteria and multi-objectives analysis take into account environmental characteristics, socio-economic conditions. This research was carried out in Jaffna peninsula which has various land use challenges including increasing farmers' income, employment and labor productivity, food security, maintaining the quality of natural resources and resolving potential conflicts situations among various stakeholders. In the first step, qualitative land evaluation was carried out for ten land use types for selecting promising land use types for each land unit using GIS-based multi-criteria evaluation method. Eight criteria were identified as being relevant to land evaluation of the selected land use types: annual rainfall, soil depth, soil texture, soil pH, drainage, salinity level, existing land use, and proximity to market. Data on agricultural production were used to quantify inputs and outputs associated with the promising land use types for each land unit. In the second step, the input-output tables were used in optimization modeling. In the optimization process, the following development objectives expressed by key stakeholders in Jaffna peninsula translated into objective functions in the optimization model: maximize agricultural income, maximize food production, and minimize ground-water use. The model output identifies which land use are selected, how much resources are needed and the expected production levels and incomes. The model results are mapped in GIS to show the spatial pattern of the selected land use types. Accordingly, the greater the priority given to the maximize income, the greater the area of cash crops such as potato and tobacco recommended. Paddy cultivation is favored when the objective is to maximize food production. When high priority is given to the objective of minimizing ground-water, a greater area is allocated to the paddy and manioc. A scenario that optimize both income and food production can be recommended to the Jaffna Peninsula for its future land use pattern, because it also minimize use of ground water. Thus, the results of this study provide a sound basis for future sustainable land use planning in Jaffna Peninsula.

Key words: Land Use Planning, Multi-Criteria, Multi-Objective, GIS, Optimization Model, Jaffna Peninsula.

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