

Optimal assignment of unusable/ waste lands effectively using improved fuzzy assignment technique

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Land resources are valuable for humans not only live but also conduct all of their economic activities on it. Allocation of land uses in a critical and optimal manner will pave the way for determining policies for the optimal utilization of land in a sustainable manner for the future, focusing on the uncertain conditions of each allocation. The objective of this study is to identify and propose effective allocations to abandoned lands such as unusable, waste and uncultivable lands using optimal land assignment plan. Fuzzy assignment technique accesses to explore how uncertainty in suitability index and the condition of the land will affect to optimal land allocation with the minimum allocation cost in this study. A major land-use classification system in Sri Lanka contains multiple levels of classification. Among them, land use categories regarded to the study area (farming village which has six unusable lands in Dompe divisional secretariat, Gampaha District) are selected as follows: Agriculture, Habitable or settled lands (Urban or rural areas), Forests, Wildlife, Reserves & Catchments areas, Underutilized Lands, Reservations (Reservoirs, Streams, & Irrigation Channels) and Barren lands. Major properties of the land were identified as land area: vaguely defined categories measured in square meters; Ownership: three possible sectors according to the ownership of the land as Private, Public and Other; Condition: discretionary parameter that is vaguely defined with three possible values: bad (0), average (0.5) and good (1) and the Facilities: four different categories (power (P), water (W), communication (C), transportation (T)). Subsequently, the properties of each land and all possible demands were identified and a suitability index was developed using those vague parameters for each assignment of lands. With the aid of the Center of Gravity (COG) method, fuzzy values were converted to their crisp equivalents. Then the cost of assignment of each land for the aforementioned purposes, were considered using with linear, triangular, and trapezoidal fuzzy membership intervals. Thereafter, Robust ranking technique was applied to calculate the numerical values for the interval and obtain the product of suitability index and cost of allocation. Finally, using the Hungarian assignment algorithm, each land was assigned optimally for its effective purposes. The linear, triangular, and trapezoidal membership degrees, the minimum cost was obtained from the trapezoidal membership degree, that is 15% lower than the linear membership degree. Therefore, study proceeds with the trapezoidal membership degree. Using hypothetical assignment costs, six lands in the study area were assigned optimally for agriculture, habitable or settled lands, forests, wildlife, reserves and catchments areas, underutilized lands, reservations, and barren lands. This will be a great social and environmental service as it will involve the re-usage of the lands that are currently abandoned. Furthermore, the findings of this study can be extended nationally to save and maintain the land resource in an optimal manner.

Key words: Optimal assignment, Fuzzy assignment, land usage, Hungarian method, Trapezoidal fuzzy numbers, waste lands

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