



## **MATHEMATICAL DECISION MODELS APPLIED FOR QUALIFYING AND PLANNING AREAS CONSIDERING NATURAL HAZARDS AND HUMAN DEALING**

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The authors were involved in the use of some Mathematical Decision Models, MDM, to improve knowledge and planning about some large natural or administrative areas for which natural soils, climate, and agro and forest uses were main factors, but human resources and results were important, natural hazards being relevant. In one line they have contributed about qualification of lands of the Community of Madrid, CM, administrative area in centre of Spain containing at North a band of mountains, in centre part of Iberian plateau and river terraces, and also Madrid metropolis, from an official study of UPM for CM qualifying lands using a FAO model from requiring minimums of a whole set of Soil Science criteria. The authors set first from these criteria a complementary additive qualification, and tried later an intermediate qualification from both using fuzzy logic. The authors were also involved, together with colleagues from Argentina et al. that are in relation with local planners, for the consideration of regions and of election of management entities for them. At these general levels they have adopted multi-criteria MDM, used a weighted PROMETHEE, and also an ELECTRE-I with the same elicited weights for the criteria and data, and at side AHP using Expert Choice from parallel comparisons among similar criteria structured in two levels. The alternatives depend on the case study, and these areas with monsoon climates have natural hazards that are decisive for their election and qualification with an initial matrix used for ELECTRE and PROMETHEE. For the natural area of Arroyos Menores at South of Rio Cuarto town, with at North the subarea of La Colacha, the loess lands are rich but suffer now from water erosions forming regressive ditches that are spoiling them, and use of soils alternatives must consider Soil Conservation and Hydraulic Management actions. The use of soils may be in diverse non compatible ways, as autochthonous forest, high value forest, traditional farms, erosion control crops with agro or with more bio-mass crops, for the Chaco Salteño area where irrigation is convenient and available near some rivers. The election of water management entities was also considered resulting here in favour of Cooperatives. For general elections for La Colacha the criteria include environmental criteria measuring erosions, economic criteria, and social criteria sets. The results were offered for effective planning and handling, done at various levels, publics and private, emphasizing long term land conservation and human results.

References exist in Spain or in Spanish Argentine literature, and general references, let note about Decision Theory:

- (1) Grau, J. B., Antón, J.M., Tarquis A. M., Andina, D. Election of water Resources Management Entity using a Multi-criteria decision (MCD) Method in Salta Province (Argentina)". CITSA 2008, Orlando 29 June-2 July, 2008.
- (2) Roy, B., D. Bouyssou. Aided Multicritère à la Décision: Méthodes et cas. Economica, Paris 1993.
- (3) Saaty, T. The Analytic Hierarchy Process, Mac Graw-Hill, New York, 1980.