Setting the windows of opportunities for sustainable agriculture using multiple goal linear programming (MGLP) - Case study: Borkhar district, Iran

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Optimal use of limited resources in the agricultural sector is important for agricultural development; particularly in developing countries were resources are relatively more limited. Mathematical programming techniques have been applied for such optimal use. Multiple goal linear programming (MGLP) is one of them which has been used in recent years. It is appropriate for explorative studies which investigate the potential use of resources to achieve the future options and the case of stakeholders' conflict as well.

Each linear programming model has input/outputs for objectives and constraints which identify by conditions of the case study. However, for strategic planning we need certain output goals. For instance considering target crop yield that lead optimization process to estimate agricultural inputs based on this predetermined goal.

In this paper we present a MGLP model for long term agricultural development in a semi-arid district in central part of Iran. Different objectives, common among various stakeholders like maximization net income have been taking into account. Also constraints like water, land, labour, agricultural machineries have considered while the water is the major one in the region. Potential yield of crops and less nitrogen loss are the target outputs, which have been considered for long term goals.

Partitioning of study area would be more accurate and with integration we could get

a general model for whole district. The spatial biophysical and socio-economic data were treated in different ways. For the biophysical data, study area was divided to 10*10km grids. Then with using a crop growth simulation model (crop growth monitoring system -CGMS), major crop yields in the district, were derived. But for the socio-economic data, each village in the district was taken into account as a planning unit.

According to indicative results and interpretation of different scenarios, scope for future development is determined. Results also indicate the optimal cropping pattern for each sort of scenarios in the region which state future progress is directly related to the improvement in water management and availability. Likewise, the model is able to determine the possibilities for food production taking different limitation and possible effects on income, employment, fertilizer and biocides use into account. Model outputs would help the decision makers as a spatial support system to predict their decisions influence in a long term horizon plan.