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Application of Bayesian Decision Networks for sustainable groundwater resources management in semi-arid regions

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This paper presents management of groundwater resource using a Bayesian Decision Network (BDN). The Kordkooy region in North East of Iran has been selected as study area. The region has been divided to three parts based on Transmissivity (T) and Electrical Conductivity (EC) values. The BDN parameters (prior probabilities and Conditional Probability Tables (CPTs) have been identified for each of the three zones. Three groups of management scenarios have been developed based on the two decision variables including "Crop pattern" and "Domestic water demand" across the three zones of the study area: 1) status quo management for all three zones representing current conditions. 2) the effect of change in cropping pattern on management endpoints and 3) the effect of increasing domestic water demand on management endpoints in the future. The outcomes arising from implementing each scenario have been predicted using the BDN for each of the zones. Results reveal that probability of drawdown in groundwater levels of southern areas is relatively high compared with other zones. Groundwater withdrawal from northern and northwestern areas of the study area should be limited due to the groundwater quality problems associated with shallow groundwater of these two zones. The ability of the Bayesian Decision Network to take into account key uncertainties in natural resources and performing a meaningful analysis in cases where there is not vast amount of information and observed data available -even based partly on expert opinion- emphasizes the advantage of this approach in groundwater resources management process, as limited data availability was a serious problem faced by groundwater resources of the study area.