A System Dynamics Analysis of Water Demand in the Lower Rio Grande

Water demand models usually lack feedback mechanisms that are inherent in socioeconomic systems. For example, they consider population trends only as exogenous scenarios that will not be affected by the internal dynamics of the system and thus leading to unreliable prediction of key system behaviors. In this study, we develop a system dynamics model that takes into account key feedback loops that impact long-term trends of water use in the Lower Rio Grande Water Planning Region. The model acts as an overlay to the NM Water Resources Research Institute's Dynamic Statewide Water Budget (DSWB) model to predict the future of water use under different scenarios. While a separate model, it uses the DSWB data outputs to define and calibrate the system relationships and behavior. The model consists of 6 modules: economy, agriculture, power use, non-ag use, urban use, and water. Stocks of surface water and groundwater interact with each other and with the rest of the model in order to simulate dynamic behavior of the hydrologic system. The model achieves minimal reliance on exogenous drivers, with only two variables (surface water inflow and precipitation) existing exogenously, making it a novel tool for policy and scenario analysis. For the next step, we will use the model to assess the implications of alternative scenarios of land management policies and strategies. The model will also help us to find leverage points of the system that may lead to sustainable use of water without sacrificing social welfare of communities.

Keywords: system dynamics, water demand, Lower Rio Grande, feedback

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