Passell, H., V. Tidwell, and E. Webb, 2002. Cooperative modeling: A tool for community-based water resource management. Southwest Hydrology 1(4):26

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Sandia National Laboratories in Albuquerque, NM, has developed a computerized dynamic simulation model of the hydrology, ecology, demography and economy in the Middle Rio Grande Basin (MRGB) to help understand and manage the water resources in that region. The model, built in the commercially-available application Powersim, has a user-friendly interface in which parameters can be varied with slider bars and switches, and provides graphical output projected to the year 2050. It allows water managers, farmers, environmentalists, educators, legislators, and others to sit together, ask questions of the model, and get answers in real time that shed light on how the region can preserve water resources.

For example, the model could analyze the impact on regional water resources if every house in the MRGB used low-flow toilets. In the MRGB, water for indoor uses comes from the aquifer in the Albuquerque Basin. Once used, that water is returned to the river through various sewage treatment plants. A reduction in indoor uses reduces the rate of aquifer depletion, but it also reduces river discharge; furthermore, retrofitting homes with low-flow toilets has economic impacts. The model illustrates all these relationships and allows the tradeoffs associated with them to be quantified.

The model illustrates and quantifies relationships between surface water, groundwater, and costs for many other alternatives as well, such as improving the irrigation efficiency in the Middle Rio Grande by lining irrigation ditches and laser-leveling fields, reducing evapotranspiration in the riparian forest by removing exotic phreatophytes, changing water pricing rates, or having the City of Albuquerque begin taking surface water from the Rio Grande.

The values that are obtained from the model are based on half a century of historic data that go into the model, the current understanding of basin hydrology and ecology, and probabilistic projections made into the future, all of which carry certain uncertainties. In spite of those uncertainties, the magnitude of impacts and the effects throughout the system are clearly shown.

Models like this are not new, but one of the problems associated with them has been their inaccessibility to water managers, policy makers and the public. Sandia's approach of "cooperative" modeling incorporates a team of representatives of farmers, developers, environmentalists, lawyers, engineers, water managers – almost all of the major stakeholders in the basin – to build and refine the model.

The stakeholder team for the MRGB analysis arose from the water planning process currently being administered by the Middle Rio Grande Water Assembly (MRGWA) and the Mid-Region Council of Governments (MRCOG). These groups, along with the Utton Transboundary Resources Center, are working together to provide the water plan requested by the New Mexico Office of the State Engineer by the summer of 2003.

Through long-term cooperative involvement in the model development process, the stakeholder team learns the structure, assumptions, limitations and strengths of the model. Continued dialogue with city, state and federal water management agencies in the region helps to further refine the model. Through this community-level development, the model has a greater chance to be more widely accepted and used.

The cooperative modeling process provides a bridge between the technical demands and capabilities of a rigorous, quantitative model, and the collaborative social processes required for natural resource management. By bridging the two, Sandia hopes to contribute to water resource sustainability in the Middle Rio Grande Basin, and beyond.