EDUCATION

Decision Support Systems in Water Education

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Water education is a hot topic throughout the West, with particular attention given to elementary school programs. However, many older students and adults have never been exposed to comprehensive educational programs on water resources that could help them make more knowledgeable personal and community decisions about water use.

Students and faculty at the University of Arizona developed an adult water education tool using Powersim, a dynamic simulation software package that produces user-friendly interfaces while hiding complicated modeling. Dynamic simulation lends itself to public education and outreach because it demonstrates effects of seemingly isolated decisions on entire water systems. Our model simulates a semi-arid region and represents residential, agricultural, industrial, and turf uses, as well as climate, flow, and riparian conditions. Model equations were based on known hydrologic and behavioral relationships. The model interfaces show only the important information, including slider bars and boxes for changing variables and charts and graphs to show results. The original parameters of the model were derived from Tucson-area data, and the defaults produce a groundwater overdraft situation.
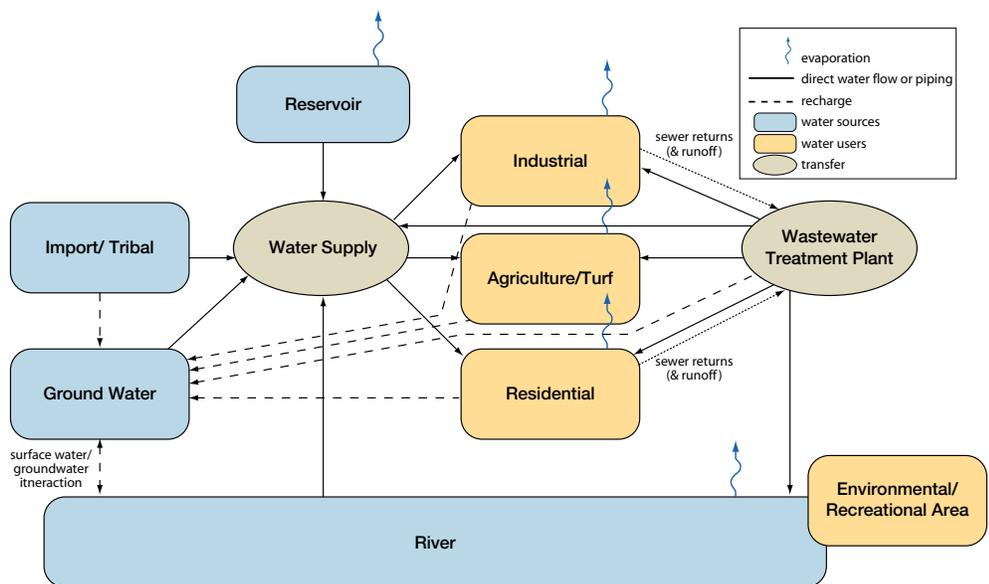
This hands-on model teaches impacts of water management and policy options by enabling the user to change a broad range of variables and view water budget and environmental effects in an attempt to meet safe yield. Variables include acreage for four crops, acreage retirement, population growth rate, people per household, the use of reclaimed water for turf and agriculture, and numerous residential conservation options. Advanced input pages allow the user to select from ten climate scenarios, put in a reservoir, import water, purchase water from tribes, use effluent for potable use, and

change the instream flow requirement. There are also limited options for customization of the region. The water budget output screen summarizes supply and demand and environmental effects, such as aquifer balance, downstream flow, and environmental economics.

Supplementary exercises introduce users to the model in stages. Introductory questions isolate variables and teach basic concepts such as consumptive use, water demand by sector, options for reclaimed water, surface water/ groundwater interactions, safe yield, effects of population growth, and conservation alternatives. A role-playing

Schematic diagram of the dynamic simulation model used for water education.

task requires students to work together to choose variables and establish a water plan that meets safe yield while gaining an understanding of options for conflict resolution. Finally, case study exercises allow the comparison of supply and demand management and the effects of various climate scenarios.

A Microsoft PowerPoint-based manual demonstrates model operation, use recommendations, examples, definitions, and discussion points, and can be used in class by instructors or by individual students. The model is best suited for teaching specific hydrologic concepts and then applying them to help the user

understand their impact on water budget choices. By allowing rapid adjustment of various factors, this simulation helps draw out the most effective options as well as potential effects that must be considered.

We have implemented the model in two semesters of a University of Arizona undergraduate class, in the Pima County Master Watershed Stewards class, and in a graduate-level water management class at the Colegio de Sonora in Hermosillo, Mexico. All English-language implementations were evaluated using pre- and post-tests, and ninety percent of the 81 students surveyed felt the model improved their understanding of class concepts. This self-assessment is validated by statistically significant improvement in nearly every knowledge assessment from pre-test to post-test. Students also indicated that they enjoyed the hands-on activity and the ability to see results immediately.

Although Powersim is commercial software, this model can be run with only user interfaces using the free, downloadable Powersim Studio Player.

For a free CD of the model and supplemental materials for personal or education/outreach use, or to be notified when the model becomes web-accessible, contact Candice Marburger at candicem@email.arizona.edu.