"Missed opportunities" in Central Arizona water management:
Reconciling the local supply of and demand for science

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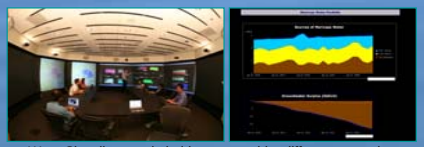
Overview

This is a study of the Decision Center for a Desert City (DCDC), a boundary organization in the Phoenix, Arizona water resource decision context, and its interactive simulation model, WaterSim. Greater Phoenix comprises a complex arrangement of institutions governing water resources in the face of climatic variation and rapid urbanization. The uncertainties surrounding sustainable water management necessitate effective exchanges within the science-policy arena. In order to characterize the relationship between the provision of science and stakeholders' information needs, this study applies Sarewitz and Pielke's (2007) "missed opportunity matrix" to interviews and focus groups with regional decision-makers through facilitated interactions with the WaterSim model. *Specifically, this poster presents preliminary findings about the nature, extent, and type of information demanded (by policy professionals) and supplied (by ASU scientists) for water resource decision-making in the Phoenix area.*



WaterSim allows stakeholders to consider different scenarios of water availability and demand, based upon the modifiable parameters of drought, climate change, population growth, land use, and water policy. Pictures left to right: inside the Decision Theater (**http://www.decisiontheater.org**) during a presentation of WaterSim, and an example screen shot showing different model parameters.

Methods: Content Analysis

Within the Decision Theater, individual interviews and 12 focus groups - consisting of water experts in data analysis, consulting, and policy from throughout Central Arizona - were facilitated in Fall 2006. WaterSim researchers attempted to discern stakeholders' perceptions of the model, their satisfaction with the science presented, and its applicability to their particular decision-making needs. The resulting transcripts were coded for reconciling the supply of and demand for scientific information. The textual analysis used the Kappa measure to test for inter-coder reliability; all of the coding for the RSD variables presented here (not/demanded and not/supplied) yielded a score of .60 (good) or higher. Preliminary descriptive codes have also been applied to each of these 4 categories to reflect the types of water management information supplied and demanded (or not) by the model, as presented in the bar graphs at right.

Preliminary Findings: Information Supplied and Demanded

The RSD framework offers a way of analyzing research portfolios or science-policy boundary activities for their appropriateness according to the *expectations* and *capacities* of potential users of the information. Research participants most commonly noted their information needs, in relation to the type of information both included and excluded in WaterSim at the time of the focus groups.

Exemplary quotes for each of the four codes

Information Not Demanded (& Contested)

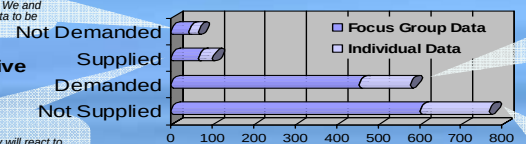
"I have concerns with the assumptions related to agricultural acreage and population growth."

"Growth projections seem too conservative. We and most cities have found DES and Census data to be wrong, based on field experience."

Information Demanded

"The model did not take into account the success of a conservation program and a shift in consumer behavior."

"[Including in the model the] impact within the Phoenix Active Management Area of recharge basin location and recovery of recharged water would be an interesting next step. I suggest providing a table summarizing all of your assumptions on a separate screen."



Information Supplied

"The assumption that all of Maricopa County will react to drought in the same manner is perhaps the only way in which you can present the data."

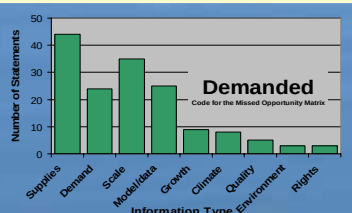
"This model would allow my organization to predict demand on surface and groundwater flows during times of water supply variability. . . . I am very familiar with data used in this study. I believe the data and the model will provide reliable predictions of future water supply and demand."

Information Not Supplied

"This model is not as relevant to the Prescott AMA"

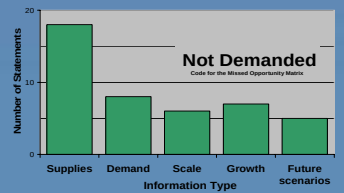
"There was not enough background to determine the scientific adequacy. Demands appeared to be high. . . .[there was] not enough data on Colorado, Salt, Verde River water supplies and recharge activities. Demands decrease during drought; [I] don't know if your model addresses this."

The Type of Water Management Information Demanded and Supplied



DEMANDED: Descriptions of information types needed or wanted by water decision-makers

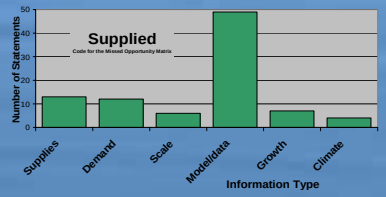
Supplies	*Data specific to particular aquifers and for additional surface water sources, including reclaimed and recharged*
Demand	*Conservation policy, Pricing*
Scale	*Provider-specific geographic scale, Short- term outlook*
Model/data	*Validity of assumptions, Reliability of data, Flexibility*
Growth	*Population, Development and Land use*
Climate	*Change & Variability*
Quality	*Usability of water*
Environment	*Ecosystem water supply needs as a limit to demand*
Rights	*Native claims & Indian settlements*



NOT DEMANDED: Descriptions of Information types contested of not wanted by water decision-makers

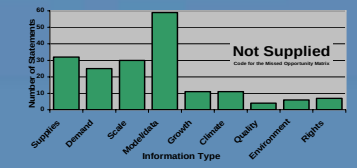
Supplies	*Accuracy/Appropriateness of assumptions regarding initial flow data and climate inputs based on historical trends*
Demand	*Accuracy/Appropriateness of assumptions regarding initial GPCD data and projected demand shifts*
Growth	*Population, Development and Land use*
Scale	*Broad geographic, Long-term outlook (2030)*
Future Scenarios	*Based on historical trends*

Stakeholders most often commented on the data and assumptions comprising the model, exhibiting both a demand for different sources of information and initial assumptions, as well as a lack of demand and dislike of certain assumptions and information sources provided. Regarding scale, participants stated that data specific to providers' jurisdiction and short-term decision-making were absent from and desirable of the model; (WaterSim generates outputs for Maricopa County and offers a 2030 outlook). Also important to decision-makers but absent from the model was the inclusion of conservation policy and pricing adjustments. The projections of land use and population growth offered by the model and particular data sources were unwanted or contested by many participants.



SUPPLIED: Descriptions of Information types water decision-makers state is included in the model

Supplies	*Groundwater-specific, Surface water/flow data based on new knowledge about drought*
Demand	*Assumptions of use (GPCD)*
Scale	*Broad spatial, Long-term outlook (2030)*
Model/data	*Scientifically- and historically-based data, Assumptions of dynamic supply and demand relationships, Flexibility (multiple modifiable variables), Familiar and useful*
Growth	*Population, Development and Land use*
Climate	*Drought conditions*



NOT SUPPLIED: Descriptions of Information types included in the model

Supplies	*Information regarding recharge, reclaimed, and other available supply sources*
Demand	*Conservation policy, Pricing, More information regarding consumer type*
Scale	*Provider-specific geographic scale, Short-time period*
Model/data	*Validity of assumptions, Reliability of data, Flexibility*
Growth	*Population, Development and Land use*
Climate	*Change & Variability*
Quality	*Usability of water*
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The "missed opportunity matrix"

The upper right and lower left quadrants indicate where opportunities to connect science and decision-making have been missed. In order to understand how DCDC's WaterSim is currently and could further meet information needs in decision-making, the next step is to overlap the four codes at center to highlight each cell of the matrix.

Supply: Does DCDC and WaterSim produce information relevant to stakeholders?	Demand: Can stakeholders benefit from WaterSim and DCDC research? — Yes	Demand — No
Yes	***Supplied, Demanded Information*** Empowered users taking advantage of well-deployed scientific information supplied by DCDC during the WaterSim presentation and/or focus group.	***Supplied Information, Not Demanded*** *Missed Opportunity* Scientific information included in WaterSim that participants *explicitly* state they do not want or need for decision-making.
No	***Demanded Information, Not Supplied*** *Missed Opportunity* Scientific information that participants state they want/need from WaterSim and DCDC that is *not* (yet) included in the model.	***Not Supplied, Not Demanded Information*** Scientific information not supplied by DCDC during the WaterSim presentation, nor wanted or demanded by policy professionals.

Closing and Future Directions

Findings indicate a "mismatch" in the relationship between stakeholder demands for science and the provisions of science offered by DCDC and WaterSim. Immediate steps for this project is to systematically apply a "comparative overlay" to these four codes, to determine specific points of overlap and missed opportunities. In other words, this process would yield an understanding of the types of information demanded by decision-makers that is both supplied and not supplied, and the types of information supplied by the model that is both demanded and not demanded. The longitudinal aspect of WaterSim will undoubtedly provide a more complete medium through which to evaluate the respective capacity of the model to facilitate a supply-demand convergence, supportive of decisions better equipped to achieve beneficial societal outcomes.

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References:

White, D. D., Wutich, A. Y., Lant, T. W., Ledlow, S. E., & Gober, P. (2007). Credibility, saliency, and legitimacy of boundary objects for water resource management decision making: Assessing stakeholder response to DCDC WaterSim. International Symposium on Society and Resource Management, Park City, Utah.

White, D. D., Corley, E. A., & White, M. S. (Forthcoming). Water managers' perceptions of the science-policy interface in Phoenix, Arizona: Implications for an emerging boundary. Society and Natural Resources.

Sarewitz, D., & Pielke, R. A.,Jr. (2007). The neglected heart of science policy: Reconciling supply of and demand for science. Environmental Science and Policy, 10(1), 5-16.

Gober, P., Redman, C. L., Lant, T., & Wutich, A. (forthcoming). WaterSim: Integrated modeling, decision support and boundary science. Unpublished manuscript.

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