

Participatory Modeling and Collaborative Water Resources Decision-Making in the Rio Sonora Basin, Mexico

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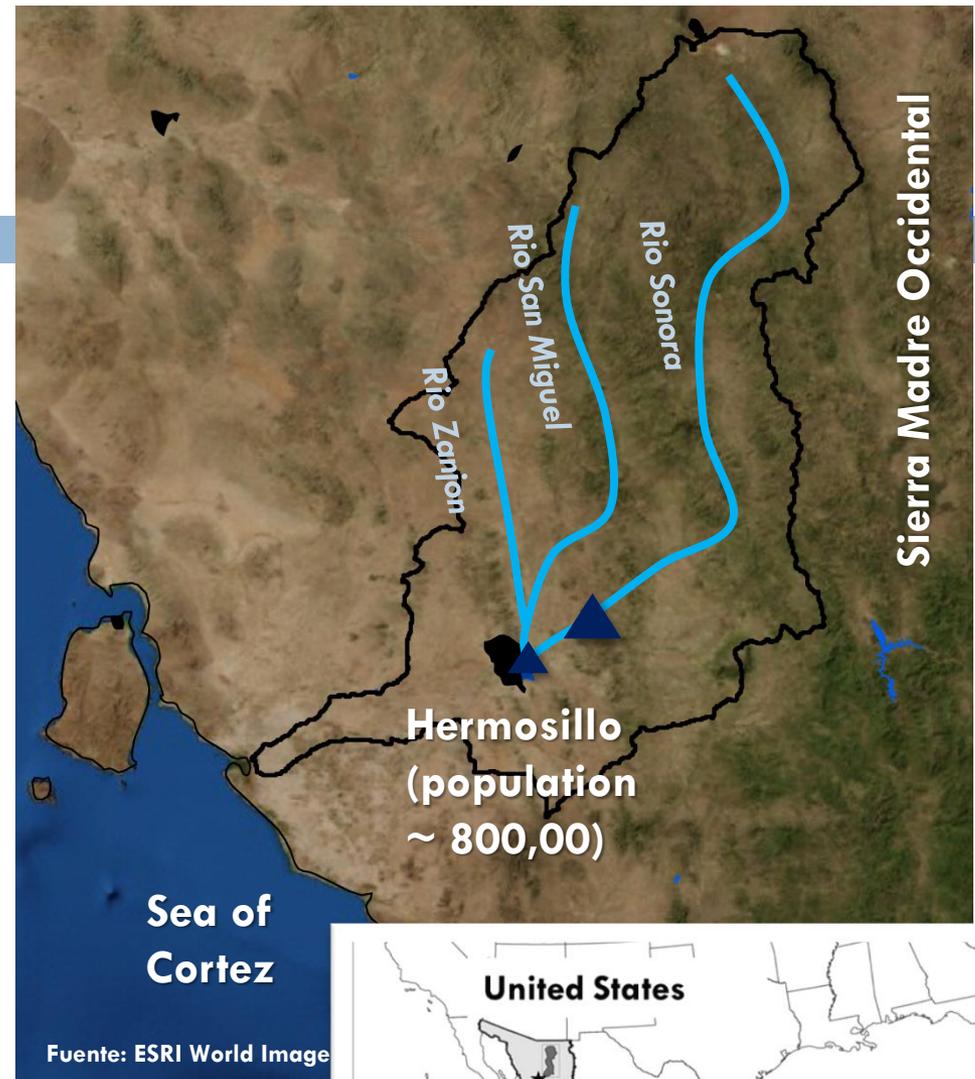
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- Workshop participants

Rio Sonora Basin (RSB)

- Climate is semi-arid, highly variable, with frequent, severe droughts.
- Major water use large-scale irrigated agriculture and a large urban area.
- Water resources infrastructure system struggles to deliver sufficient water.



Rio Sonora Basin (RSB)

- Water resources management is controversial, due to perceptions of water scarcity, conflicts among water users, and political backdrop.



<http://www.miambiente.com.mx>



<http://olasonora.com>

Project overview

- We are studying decision-making for water resources management in anticipation of climate change in the Rio Sonora River Basin, Sonora, Mexico.
- Primary question:
Can water resources systems modeling, developed within a participatory framework, contribute to management strategies in a context of **water scarcity, conflicting water uses and highly variable and changing climate conditions?**

Project focus: Participatory modeling

- Definition: process of collaboratively constructing a shared representation of a natural resources management system.
- Designed to:
 - ▣ gather and integrate a diversity of viewpoints from participants in the development of models..



-so that a collective management vision can be established and adapted as conditions change in the future.

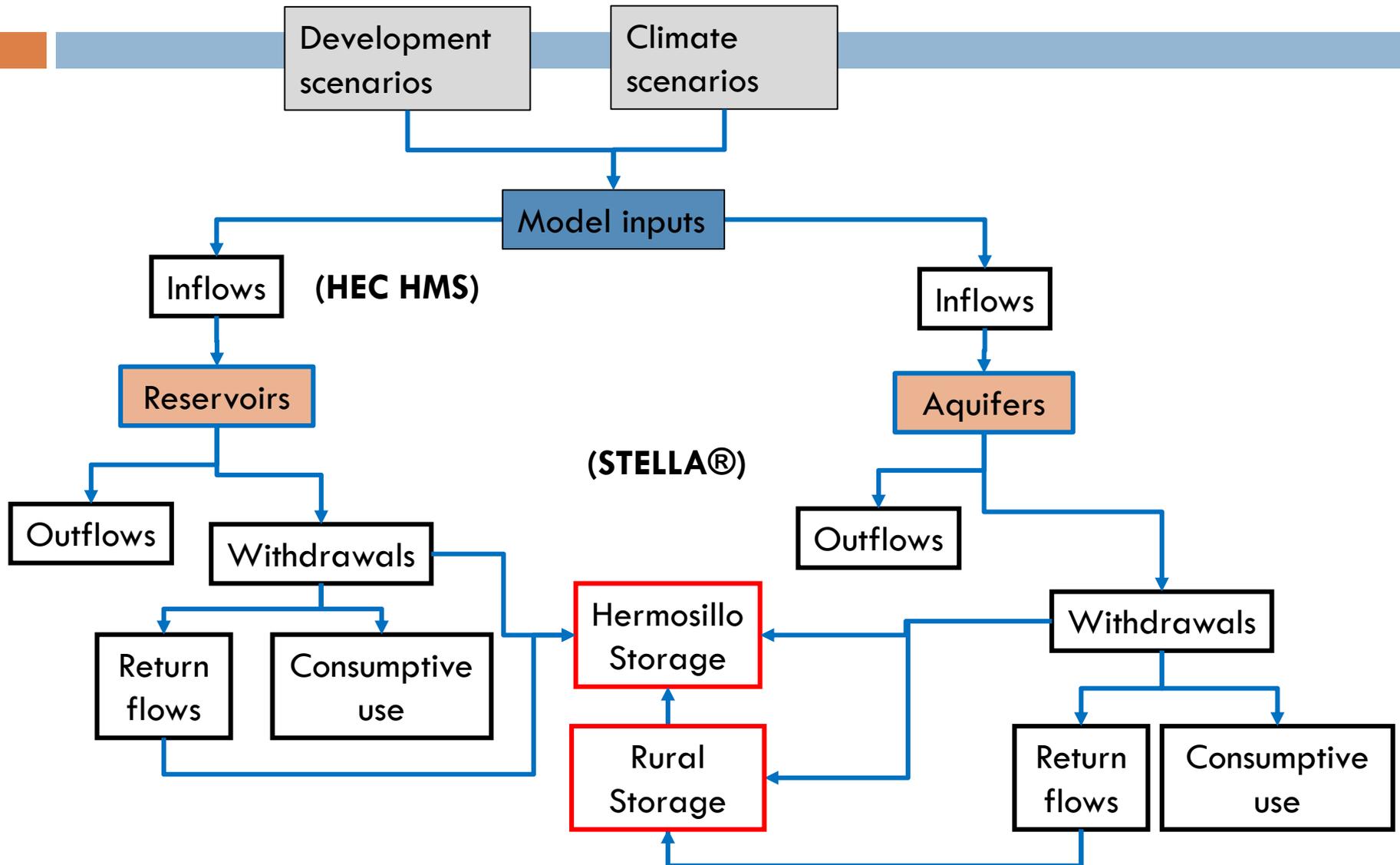
Scientific Gap

- Participatory modeling (PM) has been used in many contexts.
- But, evaluation of the outcomes is rarely done systematically (Robles Morua et al. In Press).
- Many PM organizers assert outcomes with little empirical data to support their findings.
- Some conduct post-workshop qualitative interviews, but without pre-workshop baselines, causality is problematic.
- Gold standard is pre- versus post-workshop surveys, but rarely done (Robles Morua et al. In Press).

Methods: Research Design

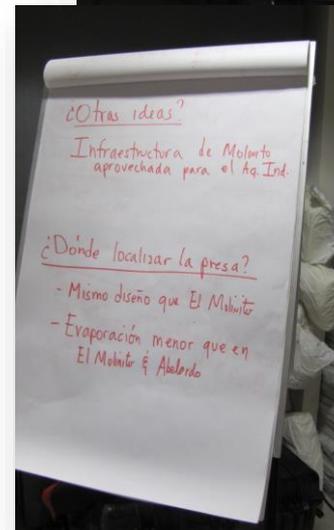
- Develop and assess conceptual models of beliefs about models
 - ▣ create, implement and analyze pre- and post-workshop surveys to analyze impact of workshops
- Develop models and forcings
 - ▣ hydrology: surface water and groundwater models
 - ▣ water resources system: supply and demand management, including infrastructure system
 - ▣ climate scenarios: downscaled climate predictions
- Conduct three participatory modeling workshops with water agency staff, academics, NGOs

Baseline model of RSB water resources system



Workshop participants

- 129 invitations were sent.
- Number of participants:
 - ▣ workshop 1/2/3: 53/28/30
 - ▣ representing 18 organizations
- 18 participants attended all three workshops and completed surveys



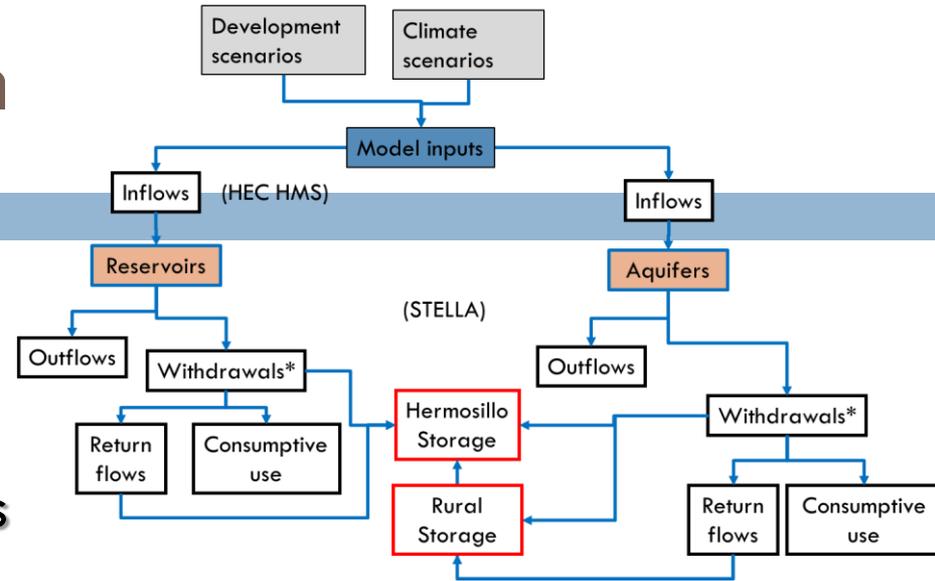
Workshop description

□ Format

- ▣ Seminars and discussion
- ▣ Practical modeling activities
- ▣ Iterative model development

□ Topics

- ▣ RSB hydrology, climate, and water management system
- ▣ Climate change in the RSB
- ▣ Hydrologic systems modeling
- ▣ Elaboration of future development scenarios
- ▣ Supply and demand management in the RSB



pre-survey

post-survey

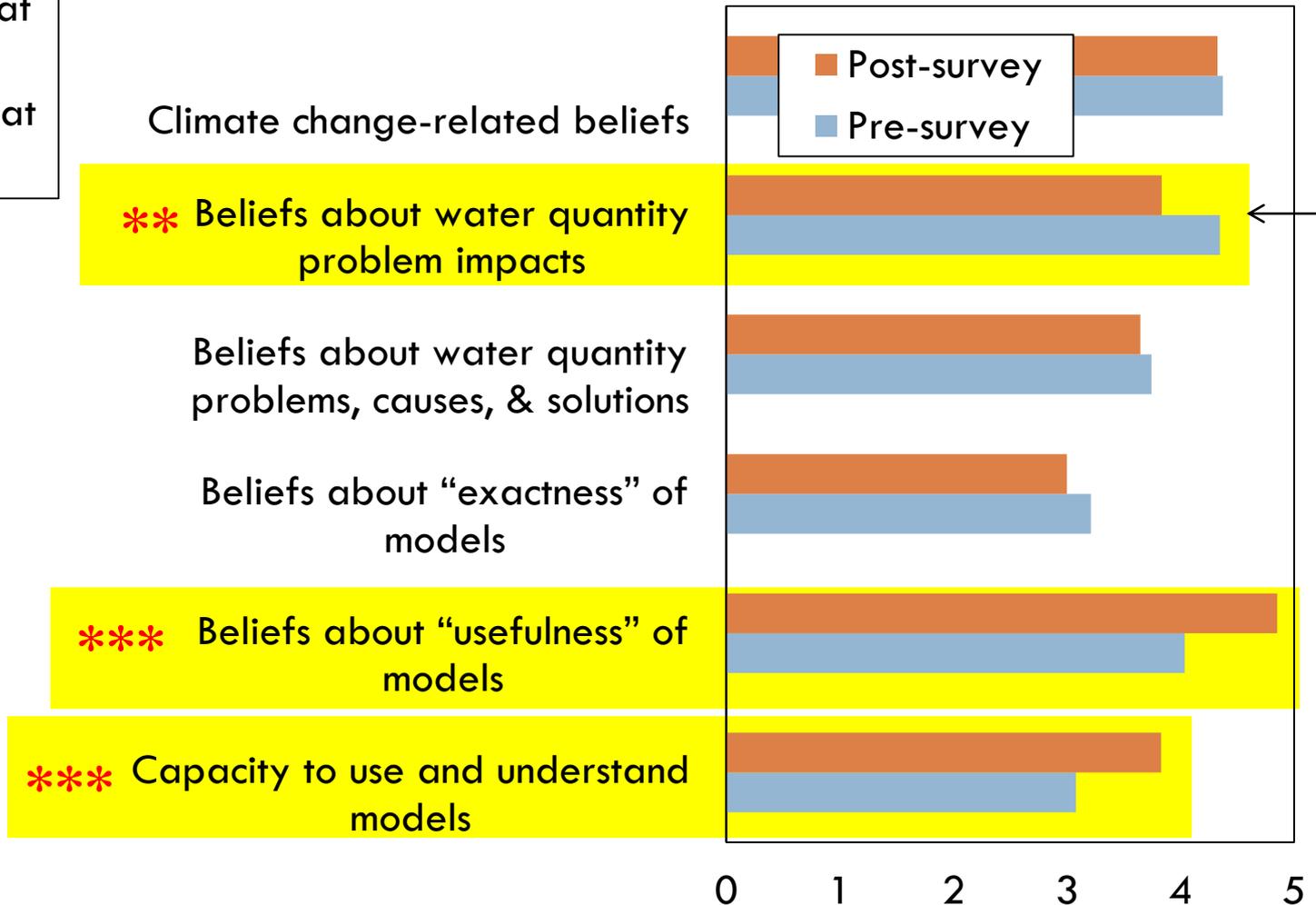
Survey scales summary

Theme/Scale	Pre/Post	# questions
Participant's prior experience with models	Pre only	7
Beliefs about personal capacity to use and understand models	Both	11
Beliefs about "usefulness" of models	Both	6
Beliefs about "exactness" of models	Both	6
Beliefs about water quantity problems, causes, and solutions	Both	3
Beliefs about water quantity problem impacts	Both	4
Climate change-related beliefs	Both	7
Results of the workshops	Post only	6
Evaluation of the process	Post only	6
Total questions	Pre: 44	Post: 49

Overall scale results

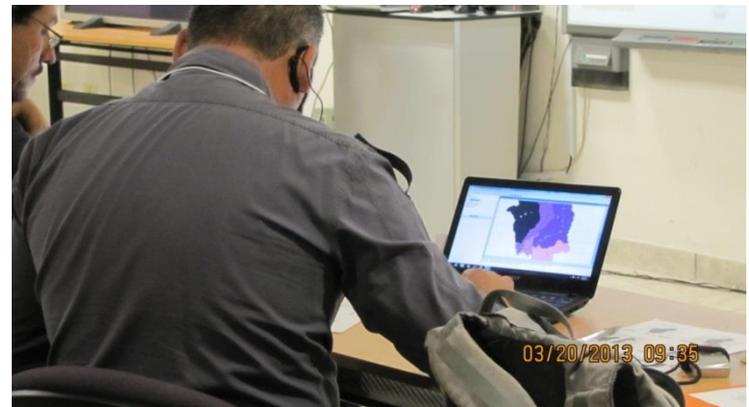
The lack of water hurts agriculture and industry and reduces economic development in our region.

*** significant at $p < 0.01$
** significant at $p < 0.025$



Selected pre- and post-survey results

- Impacts of the problems
 - ▣ More people believe that lack of water can cause ecological problems.
 - ▣ Fewer people believe that the lack of water can result in reduction in population in the region.
 - ▣ Fewer people believe that excessive exploitation of water **does not** exist in the Río Sonora.
- Social impacts of water resources decision making
 - ▣ More people believe that when there are conflicts between uses of water, priority should be given to domestic use.



Conclusions/Observations/Questions

- Most people were highly satisfied with the conduct of the workshop.
- Most people believed that they had contributed to the development of the models and that the models are useful.
- Full, rich, open dialogue about water resource decision making in the basin occurred.
- Further analysis of survey data may reveal linkages to beliefs regarding water resources.
- How do we increase participation in workshops?

Related ongoing and future work

- Optimization of existing and future reservoir operation in the Rio Sonora basin context of climate change
- Model improvements
 - ▣ tighter coupling between surface and groundwater models
 - ▣ more climate scenarios
 - ▣ modify development scenarios
 - ▣ ecological flow criteria
- Web-based participant modeling
- Expansion of participant modeling in other basins in Mexico

Bibliography of Our Work

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