



### Third workshop – Modeling Applications

November 14 – 16, 2007.

Biosphere 2 Conference Center, Oracle, Arizona.

#### Summary



The workshop took place at the “Scientific Recreation Park “of Biosphere 2 at Oracle, Arizona. Sixty-five scientists, students and government representatives from Mexico and the United States attended the workshop. The workshop consisted of plenary sessions, posters sessions, a B2 tour, exhibitions of Colorado River films and a Colorado River challenge group exercise.



The plenary session component included nine presentations by experts. A summary of the key points of each presentation is presented below. The poster sessions provided participants with the opportunity to exhibit and share their work with the rest of the

audience. A total of 18 posters were exhibited, and the best poster award was given to the poster “The Effect of Gypsum Precipitation on the Light Regime of a Euthropic Hypersaline Lake, The Salton Sea, California.” Good work Kristen Reifel!!! To view the winning poster [click here](#). [Also you can check the available abstracts for some other posters here](#).

The film exhibition consisted of two movies related to the Colorado River. The film “The Winning of Barbara Worth” is a fictional account of the Salton Sea Flood, which despite being a silent film from 1927, generated tears in some of the participants. The second film was the documentary “Plague and Pleasures of the Salton Sea.” This documentary narrated by John Waters has won 34 awards for best documentary. [If you missed it, just click here to see a good review of this documentary.](#)



Finally, the Colorado River Challenge provided participants with the opportunity to work in groups to identify five principles that could/should be considered as part of a hypothetical re-writing of the 1922 Compact. Participants formed four teams and presented their answers during dinner on the second day. An evaluation committee formed by the organizers selected team 2 as the winner. [To view the challenge and the teams' responses click here.](#)



*Thank you all for your active and enthusiastic participation!!*

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### Plenary Sessions Summary Notes

*Objective:* to provide basic knowledge about the development and use of different type of models to describe and forecast the behavior of key hydrological and biological variables in the Colorado River delta as well as to visualize the effect of different water management scenarios on the delta.

*Plenary presentations:* A total of nine presentations were given by experts. The following is a summary of the key points of each presentation. These are grouped by theme and each one is linked to the power point presentation.

#### Climate Change models – implications for the Colorado River

This section consisted of three separate presentations describing the expected implications of climate change in the Colorado River and its delta. [Dr. Glen M. MacDonald](#) (University of California) presented the talk, “Uneasy Paleoclimatic Model Prognosis for the Colorado Delta. He indicated that the existing drought in the Colorado River has the characteristics of being a “perfect drought” period. These periods have only occurred a few times since year 800, but in some cases have lasted for up to 60 years. The current drought situation in the basin is not looking good for the river. It may be that we are in the beginning of a perfect drought period. The causes of the drought in the Colorado River basin in the last 500 years are definitely associated with the patterns of circulation associated with El Nino/Southern Oscillation (ENSO)-related conditions in the Pacific Ocean. However, there seem to be other circulation patterns that also are contributing to these severe drought conditions.

[Dr. Gregg Garfin](#) (University of Arizona) confirmed that recent climate change projections for the Colorado River are not optimistic, with predicted decreases in annual river flows from 4% to up to 45% by mid century. Despite this wide range in the predictions from different models, all predict a decrease in flows. The expected implication is a decrease surface water supply reliability for the seven basin states in the US and Mexico. The severity will depend on the observed reduction in flows and the water management decisions that are made in preparation for the reduction in flows. Another impact from climate change in the Delta is the rise in sea level.

[Dr. Holly Hartmann](#) (University of Arizona) described the differences among the different models and asked whether these differences reflect climate uncertainty or if they result from different methods and models. One key question she addressed is whether the current Southwest drought is a once-or-twice-a-century drought like those of the past 500 years or a harbinger of things to come - a different type of drought that we have not observed before? The model results agree more when application details agree more, resulting in a reduction of differences. But their agreement is based on different processes, atmospheric forcing (precipitation, temperature) and land processes. The following recommendations/observations (Mike Dettinger) were presented: 1) Snowmelt change must play a role in models used to project warming-induced drying and warming-induced  $\Delta E$ ; 2) it will be important to be cautious about GCM-based P-E for US West; 3) it will be necessary to work at spatial resolutions on order of 10 km to get reasonable elevations and "concentrations" of precipitation; 4) a really weak aspect of existing hydro models is the linkage between snowmelt timing and  $\Delta PET$  (this connection determines whether snow-buffering of runoff change is large or small, positive or negative); 5) and Colorado River Basin may respond to warming differently from Sierra & Columbia Basins.

"Fisheries Resources Management in the Upper Gulf California: An Ecosystem Approach."

[Dr.M. Veronica Morales-Zarate](#) (Centro de Investigaciones del Noroeste, La Paz. B. C.S. Mexico) after presenting an overview of modeling principles, described an ECOPATH model of the Upper Gulf of California as a case study of fisheries models. The case study focused on the trophic structure of the Upper Gulf of California and its biomass flows among components and species of synergetic and commercial interest using a trophic modeling approach. A predator matrix of fish catches for several species and other ecological and physical parameters were used in the model. Results show that the Upper Gulf is highly dynamic, more complex, and probably a more mature ecosystem compared to other systems in Mexico. The main conclusions presented were: discharge of fresh water from Colorado River brings modification to the entire system, modifying most species populations; including environmental parameters in simulations allows more and better technical elements to improve resources management; and future scenarios must be implemented to analyse the role of the new polygon as well as alternative MPA size and designs

"Population and economy on the US-Mexico border from 1950 to the present."

[Dr. James Gerber](#) (San Diego State University) described the main characteristics of the US-Mexico border region in terms of its demographic, economic, and human well-being (development) trajectories. Dr. Gerber explained that there are many different regions to the border, not a single "border" region. He explained that in general, the economic gap between the U.S. and Mexico is much smaller in the border region than the interiors of the countries, but there are exceptions, for example the importance of manufacturing is much greater south of the border. One of the biggest challenges is the rapid rate of population growth: housing stock, paved roads, sewage treatment, clean water, schools, health care, and rapid growth is due to rapid job creation in the border regions (both sides) over a long period of time. Concluding remarks about Mexico and the US presented by Dr. Gerber help to understand the political dynamics of the border region.

"Hydrologic models: Fundaments and applications"

[Dr. Jorge Ramírez Hernández](#) ( Universidad Autónoma de Baja California, Mexicali. México) presented a quick overview of principles for the development and application of groundwater models by using the Colorado River Delta as a case

study. Dr. Ramirez described the process of going from a conceptual model to a mathematical model at two spatial scales, one for the entire irrigation district and one for a restoration site. For the irrigation district or regional model, he presented results for the stationary and transient solutions of the model. For the restoration site, he indicated that the U of A and the UABC are collaborating to develop a more detailed groundwater model. In particular, students from UABC are developing a detailed soil map and monitoring observation wells in order to estimate hydraulic conductivity for the entire 4,400 acre site, information that will be incorporated into the groundwater model.

“WaterSim: An Integrated Model for Scenario Development and Decision Support.”

[Patricia Gober](#) (Arizona State University) discussed WaterSim, an interactive model for scenario development and decision support being developed by the Decision Center for a Desert City at Arizona State University. The purpose of WaterSim is to provide decision-makers and the public with “what if” scenarios of water availability in Maricopa County, Arizona under conditions of an uncertain climate and rapid population growth. Colorado River water is delivered to the Phoenix area by the Central Arizona Project. WaterSim developers are evaluating the usefulness of the program for decision-makers by engaging focus groups in a “decision theater.” Preliminary results indicate that users find WaterSim to be a useful decision-making tool. In the future, the program developers would like to determine if, after using WaterSim, users change their opinions about water use and sustainability in Maricopa County

“Making Decisions Under Uncertainty: Applications in Conservation Biology.”

[Helen Regan](#) (University of California Riverside) presented a method for making conservation biology decisions under uncertainty. She first reviewed the strengths and weakness of traditional methods such as expert opinion and decision tables. She concluded that because groups often defer to the highest status member and probabilistic models of uncertainty are often unreliable, new methods are necessary. Dr. Regan presented the info-gap method of decision-making, which provides the highest degree of uncertainty a certain action can tolerate. She then applied this model to decisions about marine reserve design

"Ecosystem Changes and Water Policy Choices: Four Scenarios for the Lower Colorado River Basin to 2050."

[Karen Hyun and Mark Lellouch](#) (University of Rhode Island And Sonoran Institute, Tucson) presented four hypothetical scenarios that help to visualize the spectrum of water and land policy choices and impacts that decision makers could be facing based on the climate change scenarios described by other speakers. These hypothetical scenarios were developed based on diverse drivers of change such as climate change, population growth, and policies as well as outcomes like ecosystem changes in the Delta and changes in human well-being in the Lower Basin. The speakers used the Millennium Ecosystem Assessment as a framework for presenting the work. The speakers presented a set of recommendations and areas future research.

Thank you all!