Collaborative Stakeholder-Driven Water-Energy-Ag-Ecosystems Modeling and Planning for Long Term Resource Sustainability

Sandia National Laboratories

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There's no water crisis . . .

- Ever increasing human population and increasing resource demand and consumption (water, energy, food . . .) are leading to local, regional and global ecosystem declines, which lead to:
  - Declines in ecosystem services
  - Resource scarcity (water, energy, food, climate)
- Dealing with the root cause will be more effective than dealing with the manifestations
- This is not just a technical problem

Ecosystem services

- Services provided free-of-charge to the human economy by well-functioning ecosystems include
  - freshwater delivery
  - maintenance of atmospheric composition (fresh air, carbon cycling, climate change)
  - energy
  - waste disposal and decomposition
  - pollination, fisheries, food in general
  - public health, disease mitigation
  - production of soils, grasslands, timber, and biodiversity in general.

Costanza et al. (1997) placed the value of these ecosystem services at almost twice the value of global GDP.

MEA (2005) estimated that wetlands alone provide services worth $200-940 billion per year.

We must find a way . . .

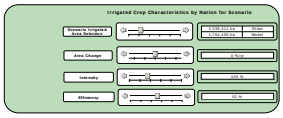
- To better understand, quantify, and make explicit the linkages between
  - population growth
  - consumption growth
  - ecosystem decline
  - resource scarcity
  - political, economic and social stability
  - human security
- To communicate it all to policy makers and the public

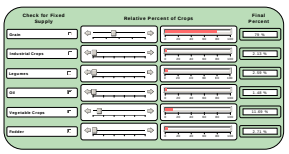
Collaborative, Stakeholder-Driven Resource Modeling and Management

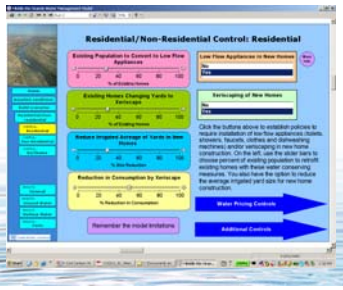
- Systems modeling with multi-disciplinary, multi-sector partners
  - water, energy, food, environment, security, policy
  - build user-friendly models for use by policy makers, academics, students, the public
  - construct future scenarios, simulate and evaluate tradeoffs and consequenses
  - modeling and resource management are adaptive
  - approach is social & intellectual, not only technical
  - educate decision makers and citizens – democratize resource planning
- This was not possible 20 years ago . . .

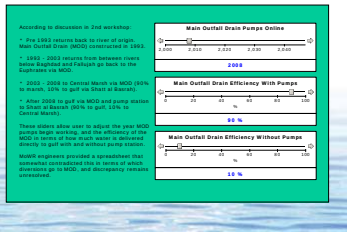
INTERACTIVE, USER FRIENDLY MODELS

Allows for real time construction and evaluation of competing development strategies



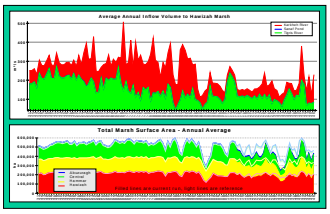


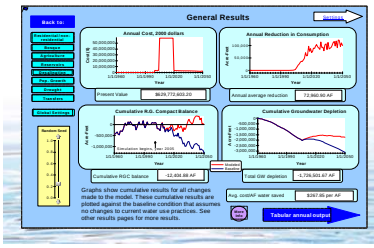


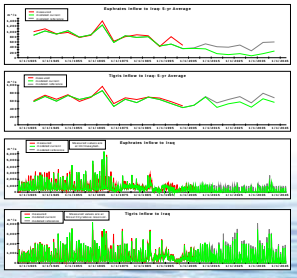


GRAPHICAL OUTPUT

Allows real time comparison of alternatives, education of stakeholders and policy makers, and development of rigorous, quantitative development plans







Collaborative Stakeholder Involvement

- Collaborative stakeholder involvement is key
  - Brings together experts from across disciplines and sectors
  - Over months or years they work together to better understand interdependencies among systems
  - Their collaborative experience is captured in a quantitative model
  - Model is clearinghouse for best data and knowledge
- Model *AND* the collaborative process are both important products of the work
  - Both form the structure for ongoing planning, evaluation of consequences, improvement of models, and so on . . .

Collaborative Modeling & Planning Project Examples

- Aral Sea Basin
- Middle and Lower Rio Grande
- Gila Basin
- Mimbres Basin
- US Water/Energy Interdependencies
- Willamette Basin
- Iraq/Tigris-Euphrates
- Libya Great Man Made River Basin
- Santa Fe Renewables (SNL/Wild Earth Guardians collaboration)
- Atlantic Council 21st Century Marshall Plan for Water, Energy and Agriculture in Developing Nations
- Ecology of National Security/Environmental Security
- Algae Biofuels

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