



Cutting-Edge Technologies for Burgeoning Economies

How do you make good decisions?

Ray E. Finley
Department Manager, Earth Systems
Sandia National Laboratories
PO Box 5800, Mail Stop 0735
Albuquerque, NM 87185
505-844-8444462

refinle@sandia.gov

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.



Sandia National Laboratories

Cutting Edge Technologies

- Goal – Revolutionize infrastructure in Africa!
- The needs are many...but resources are limited!



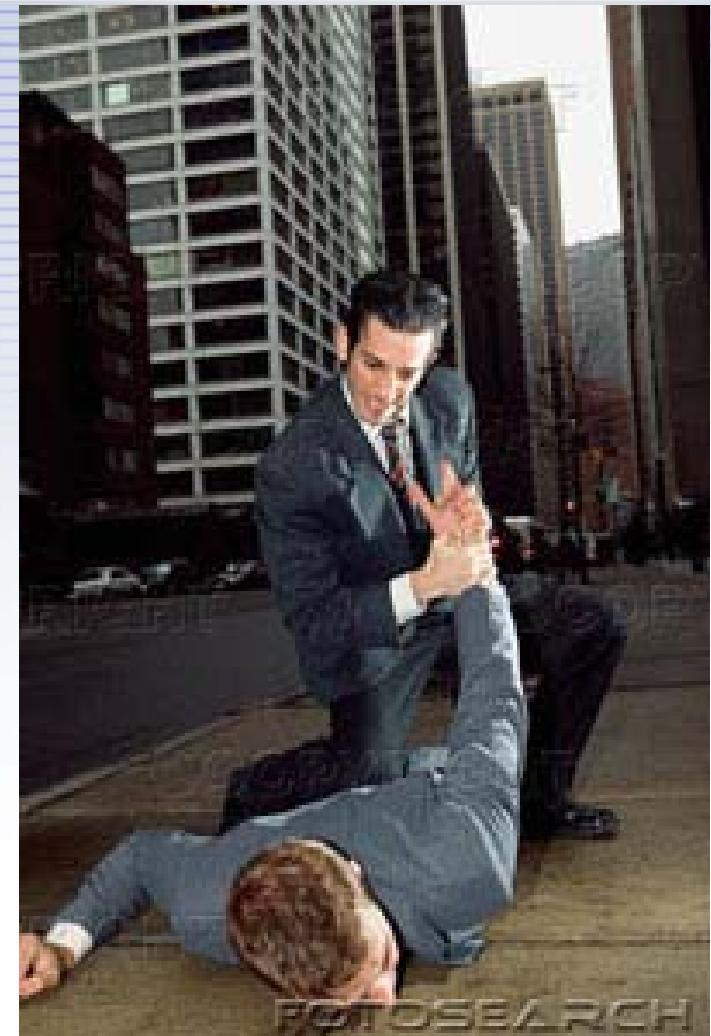
- How do you prioritize investments? How do you make the best decisions? How do you reach agreement?

Motivation

**GENTLEMAN, IT APPEARS TO
BE UNANIMOUS**

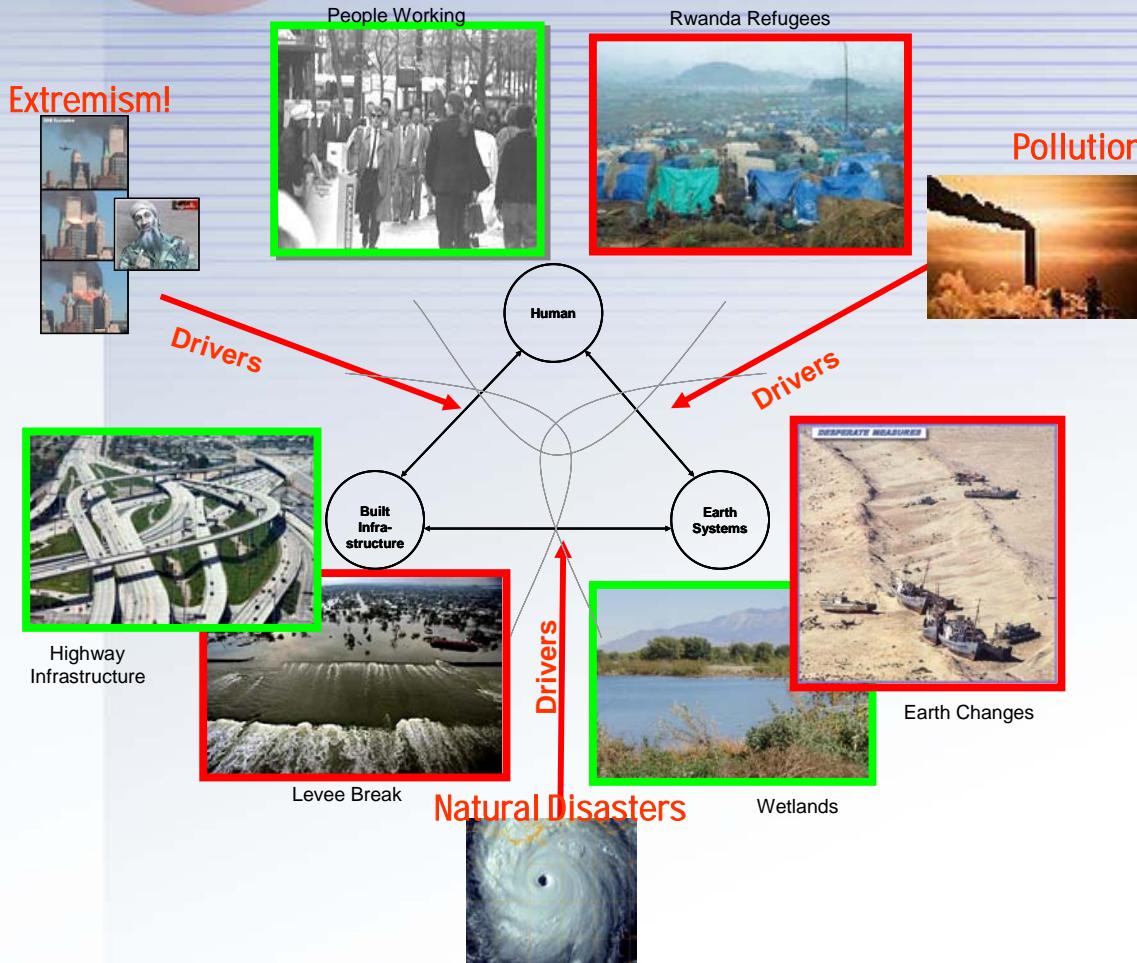
THAT WE CANNOT AGREE

-unattributed



Sandia National Laboratories

Motivation



The worlds problems are complex and interdependent

Solutions are not transparent and often not optimal

A new paradigm in decision-making is needed



Sandia National Laboratories

Resources Management: A Decision-Support Approach

**What: Methods and tools to assist
“decision-makers” in making decisions!**

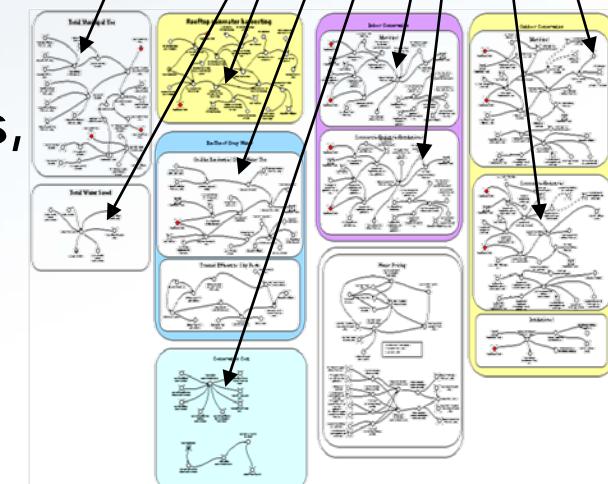
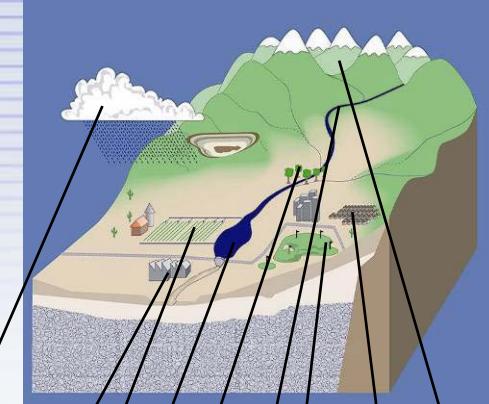
**These tools are being applied in New
Mexico, the United States, and
Internationally**

**Quantitatively compare resource
management alternatives and scenarios,
in terms of:**

- energy, water, land use, etc. savings,
and cost to implement and maintain
the alternative**

**Engage policy makers, stakeholders, and
the public in the decision process**

**Convey the interconnectedness and
complexity of regional systems**



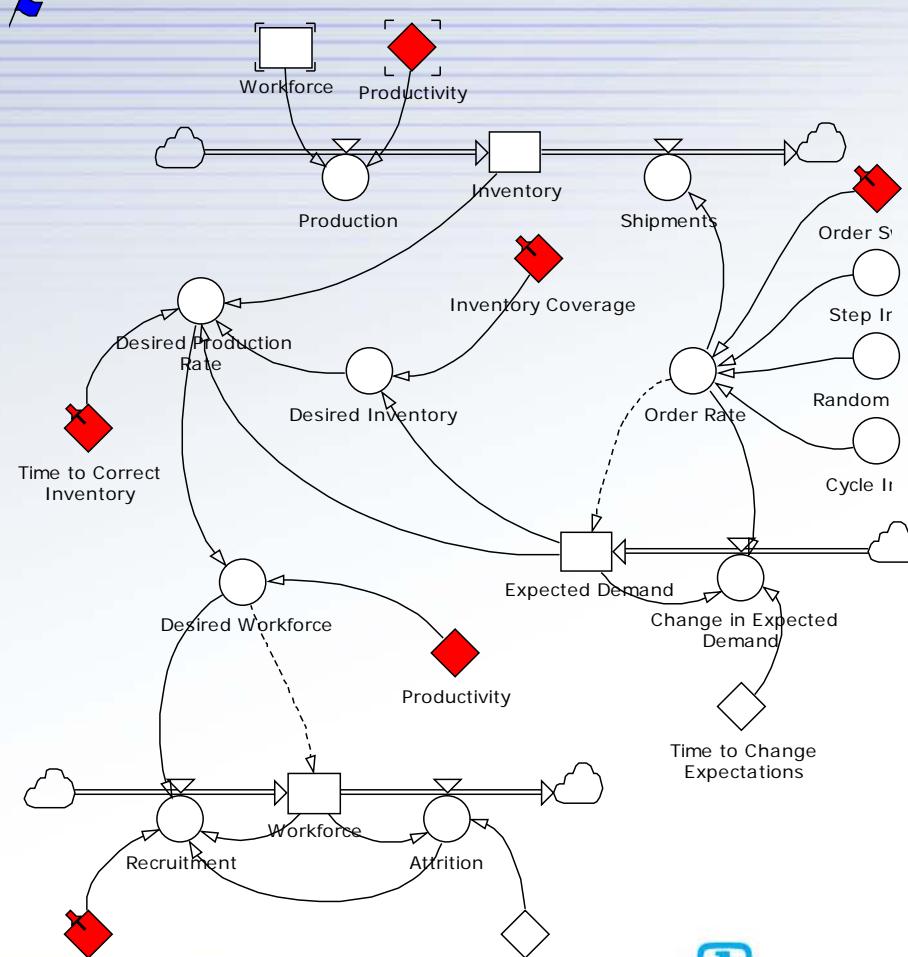
Sandia National Laboratories

Resources Management

A Decision Support Approach

How: System Dynamics Modeling! Stakeholder driven collaborative process

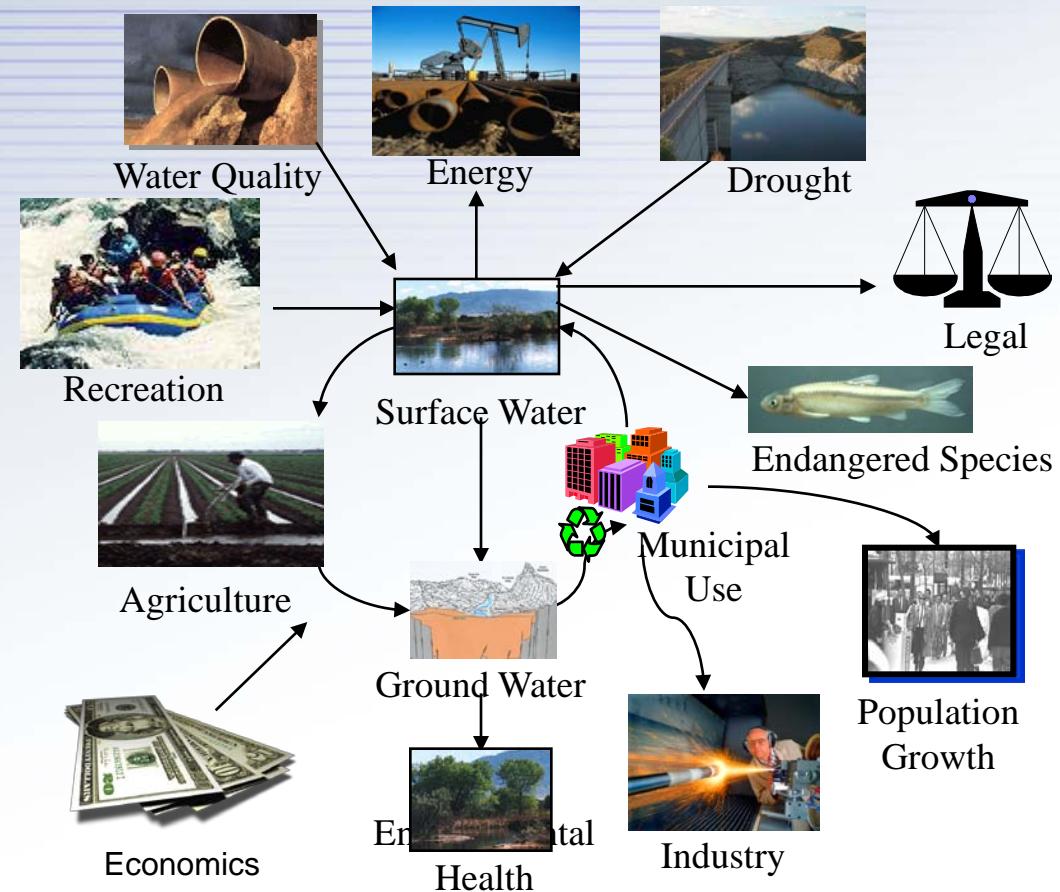
- Formulated as a temporally dynamic spatially aggregated commodity balance
- Same basis as most physical and social models
- Difference is in the temporal and spatial scales



Integrated Decision Support Modeling

System Dynamics: Integrative Modeling

- Same framework can be used to track changes in multiple, disparate systems
- Integrate over the broad range of factors influencing resource management
- Accommodates uncertainty for decision makers
- Easily modified for what-if decision making



Some Examples

Tools (models) are being applied to solve difficult water & resource management problems:

Middle Rio Grande

Upper Rio Grande

Lower Rio Grande (US-Mexico)

Gila/Mimbres Basin

Barton Springs Aquifer (Texas)

Willamette River Basin (Oregon)

Water Web Portal ([web tool to enable long-distance collaborating](#))

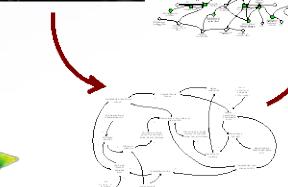
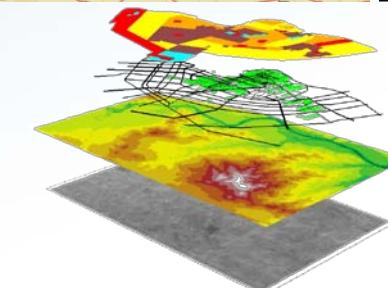
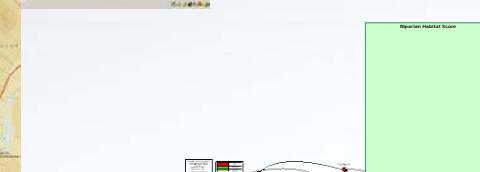
Algae and cellulosic ethanol biofuel models (national)

Algae Roadmap Model for technology deployment (national)

Various Energy/Fuel/Transportation Models

Energy-Water Toolbox Model

International



Sandia National Laboratories

Some More Examples

Iraq – Through the DoS Iraq Transition Assistance Office – Have developed a country-wide water-energy-ag model to aid in resource management decision-making AND personnel capacity-building

CSIS/SNL – addresses major issues in U.S. Foreign Policy related to water resources management and technology – Upcoming CSIS workshop planned in Autumn, 2009 to draw attention to the opportunity of systems models and technology to inform policy in environmental security (inviting intel, DoD, DOE-IN, DoS, AC, others)

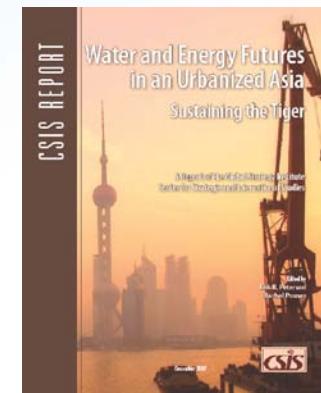
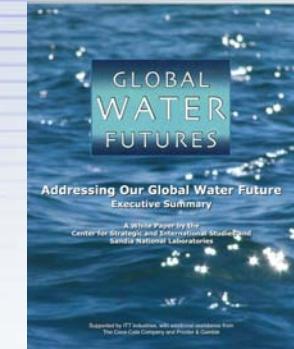
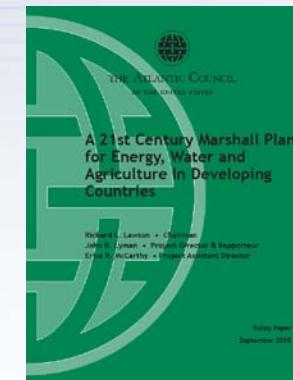
21st Century Marshall Plan for Energy-Water-Agriculture in Developing Countries – Led by the Atlantic Council, this effort proposes a new paradigm for US Foreign Aid investments

Ecology of National Security/Environmental Security – Advocating a proactive and holistic systems approach to the great environmental challenges of our time

Singapore - Have developed early warning system and water quality management software system for their Public Utility Board, and are developing a country-wide energy system model to aid decision-makers at the Energy Market Authority.

Libya – Are working with DOS and DOE to engage Libyan scientists and engineers in water system management employing our system models

US-Mexico – Have collaborated with Mexican water professionals to develop a preliminary water resource management model for the entire Rio Grande, including the transboundary reaches.



Sandia National Laboratories