The Water Evaluation and Planning (WEAP) System: A Decision Support Tool for Water Management Adaptation to Climate Change

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Financed 3 research teams to attempt to develop a climate change impact and adaptation framework for water resources and aquatic ecosystems.

Our research team, comprised of:
  • Stockholm Environment Institute
  • National Center for Atmospheric Research
  • Natural Heritage Institute

used the *Water Evaluation and Planning (WEAP)* system as a starting point for a pilot application in California’s Sacramento Valley.
Let’s start with a quick introduction to the original version of WEAP, and most other water resource planning models for the matter.
A Simple Planning Model
Critical question: How should water be allocated to various uses in time of shortage?

Critical question: How can these operations be constrained to protect the services provided by the river?

Critical question: How should infrastructure in the system (e.g. dams, diversion works, etc) be operated to achieve maximum benefit?

Critical question: How will allocation, operations and operating constraints change if new management strategies are introduced into the system?
What are we assuming?

1. That we know how much water is flowing at the top of each river.
2. That we know how much water is flowing into or out of the river as it moves downstream.
3. That we know what the water demands are with certainty.
4. Basicly, that this system has been removed from it HYDROLOGIC context.
What do we do now?
Critical question: How does rainfall on a catchment translate into flow in a river?


Critical question: How does movement along these pathways impact the magnitude, timing, duration and frequency of river flows?
WEAP, with its integrated Hydrology Molude, provides a framework for answering both set of questions.
Application of WEAP to the American River Basin
Input Data Requirements

- Catchment delineation and characterization
- Climate data
- Infrastructure operations
Model Catchments
Modeled Rivers
Modeled Reservoirs
Modeled Transfers
Calibration Results
North Fork American at North Fork Dam
A Climate Change Scenario
Sample Climate Scenario

• Temperature increase of 1 degree Celsius by 2020.

• Decrease in precipitation of 5% by 2020.
Upper South Fork Silver Creek SWE

1996-2000

2016-2020
Ice House Storage

1996-2000

2016-2020
Ice House Generation

1996-2000

2016-2020
Adaptation – Alter Ice House Guide Curve
Conclusions

• The hydrology module is a powerful tool for considering changing catchment dynamics.
• Hydrology is essential for conducting rigorous analysis of climate change impacts.
• Hydrology could be very interesting for sectoral economic analysis because it considers several resources in a catchment, rainfed and irrigated agriculture, forest and range management, fish appropriate flows.
• Increasing activity is taking place with the WEAP21 Framework in California.