System-Wide Water Resource Management – Tools of the Trade

Goals

Provide the Corps and its partners the capabilities to:

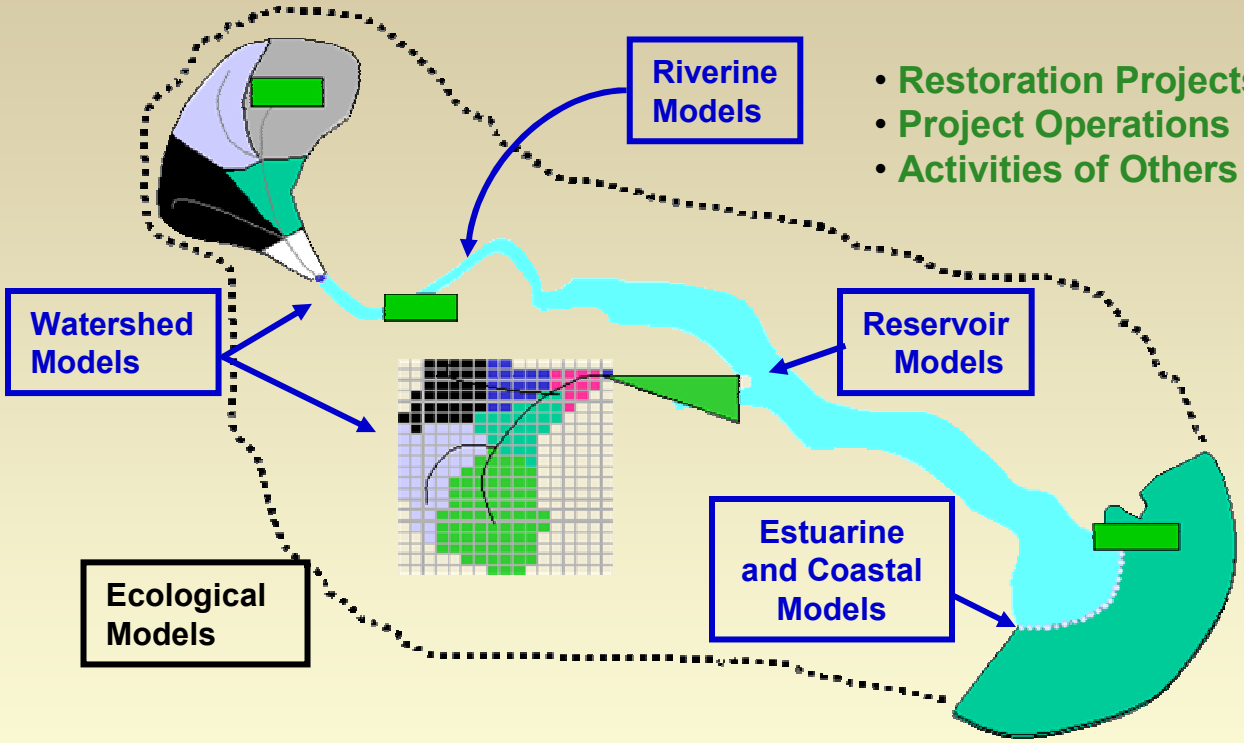
- **Balance development with ecosystem requirements**
- **Restore and manage water resources over multiple spatial and temporal scales**
- **Achieve environmental sustainability**

System-Wide Water Resources Program

Support for Civil Works Strategic Plan

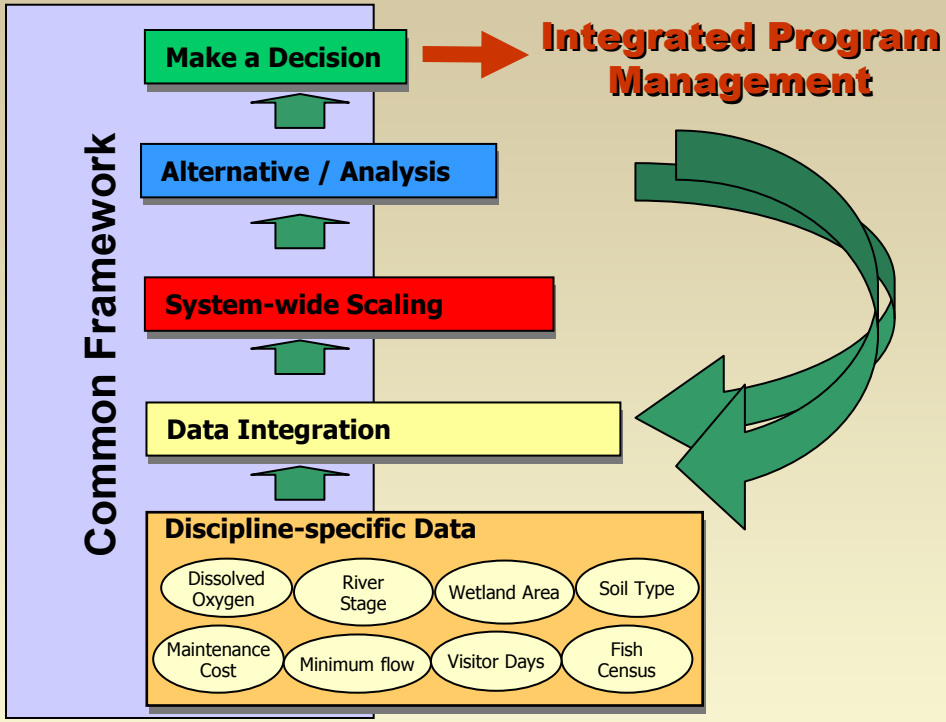
- **Supports goals of ecosystem restoration and environmental sustainability**
- **Provides technology for meeting mission requirements over broad temporal and spatial scales**
- **Designed to maximize interactions within the Corps and with its partners**

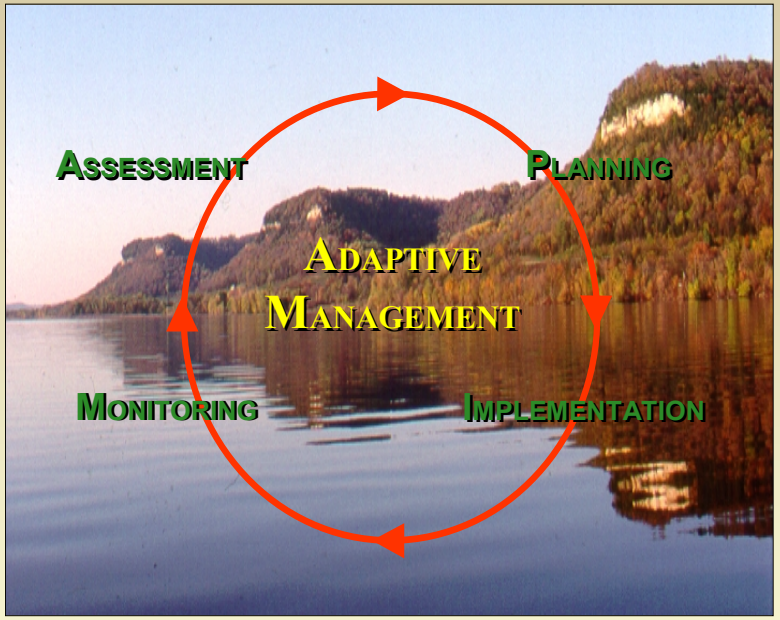
Comprehensive Water Resources Management



Technologies for system-wide assessments

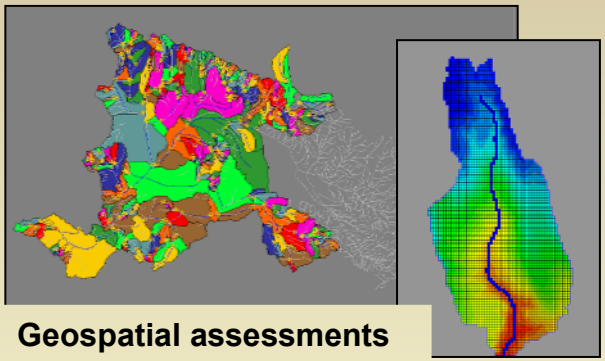
Decision-Making Process





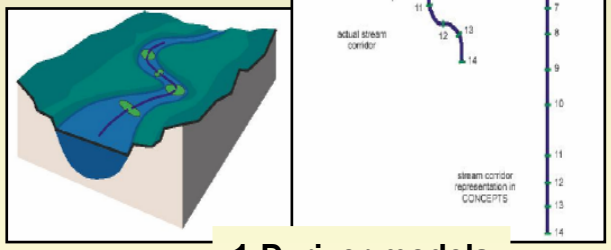
Combines – scientific assessments – stakeholder review and principles of adaptive management in an Iterative process for desired sustainable management

Tiered Approach to Water Resources Management



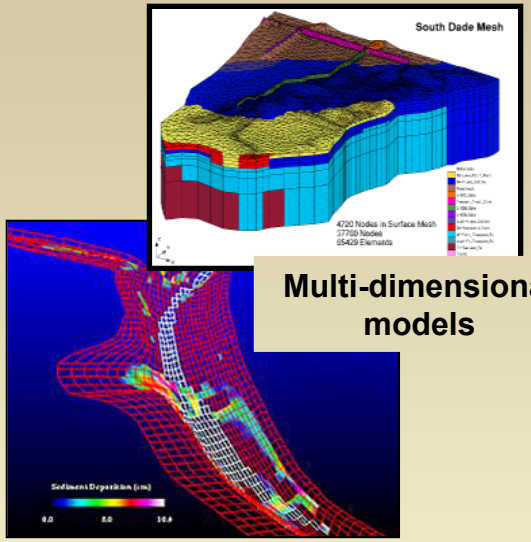
Geospatial assessments

Data to Model Integration



1-D river models

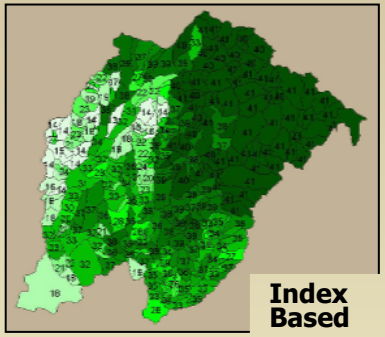
Model to Model Integration



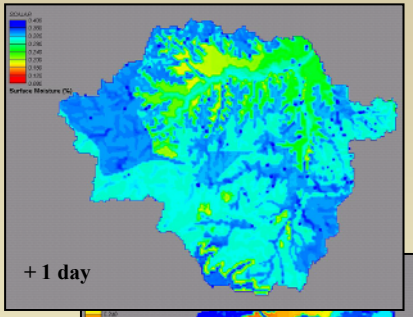
Multi-dimensional models

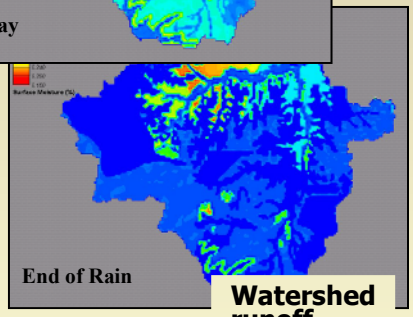
Allows assessments at various levels of tool "fidelity" to meet stakeholder requirements with consideration for available capabilities and resources

Assessment Approaches

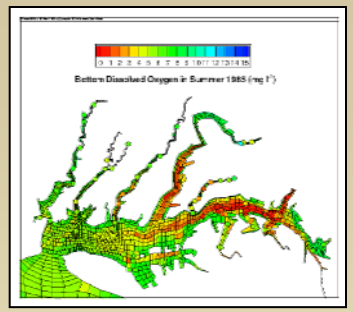


Index Based

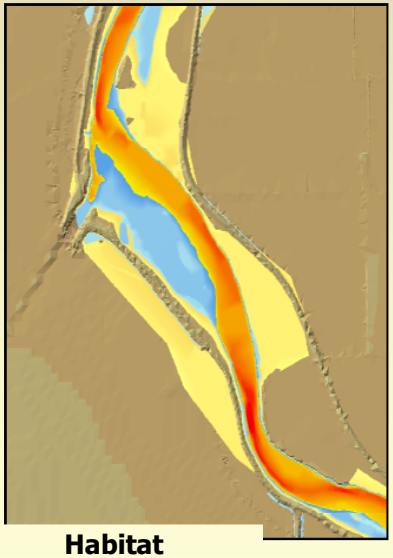




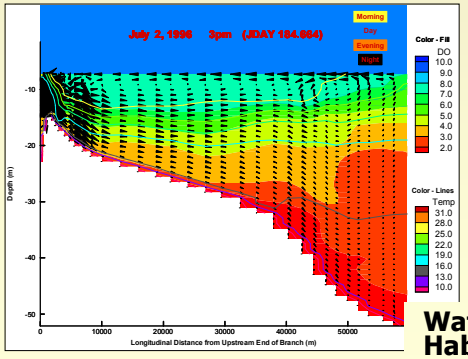
Watershed runoff



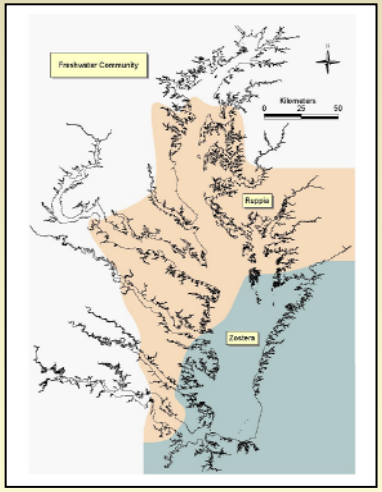
Hydrodynamics and Water Quality



Habitat



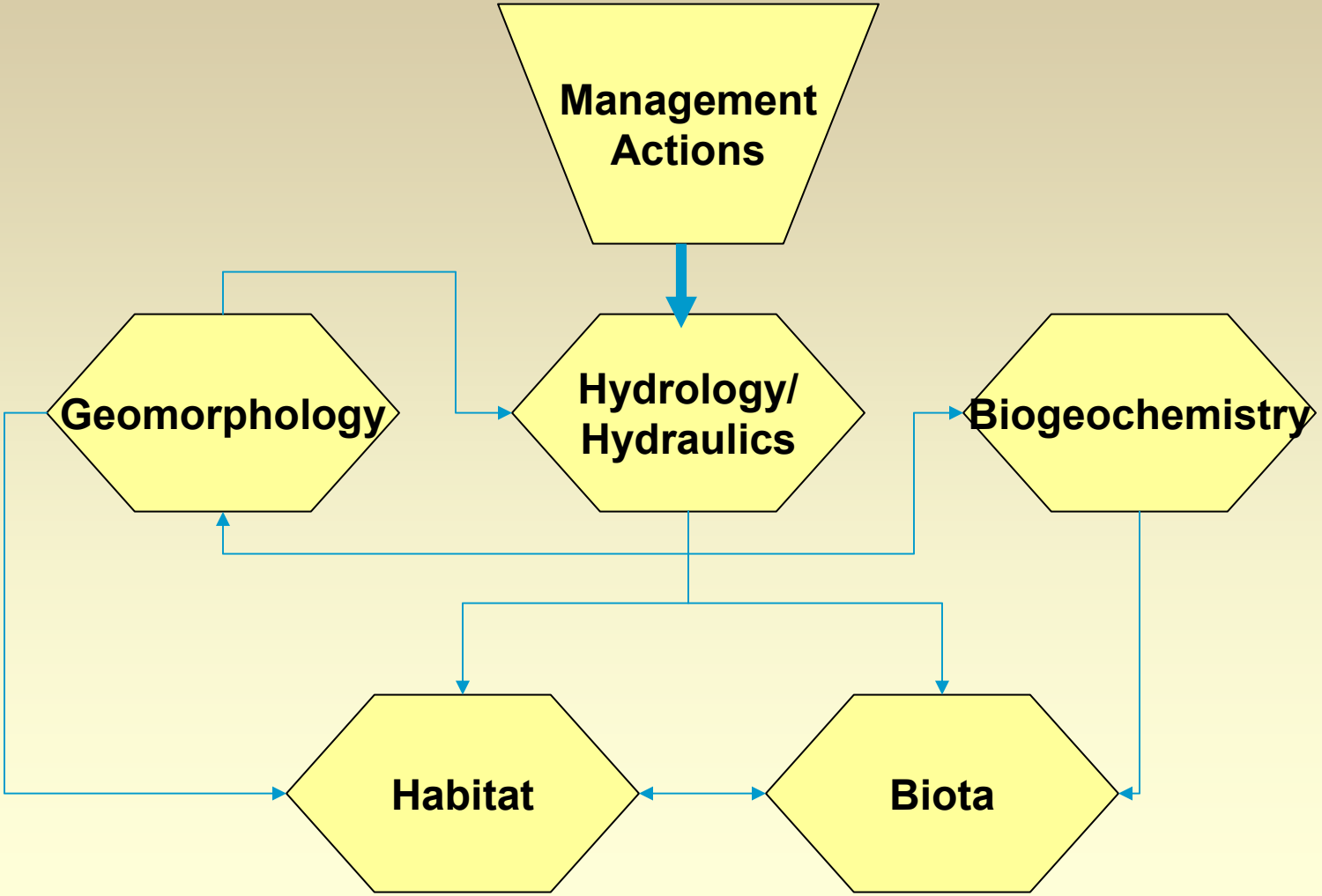
Water Quality and Habitat



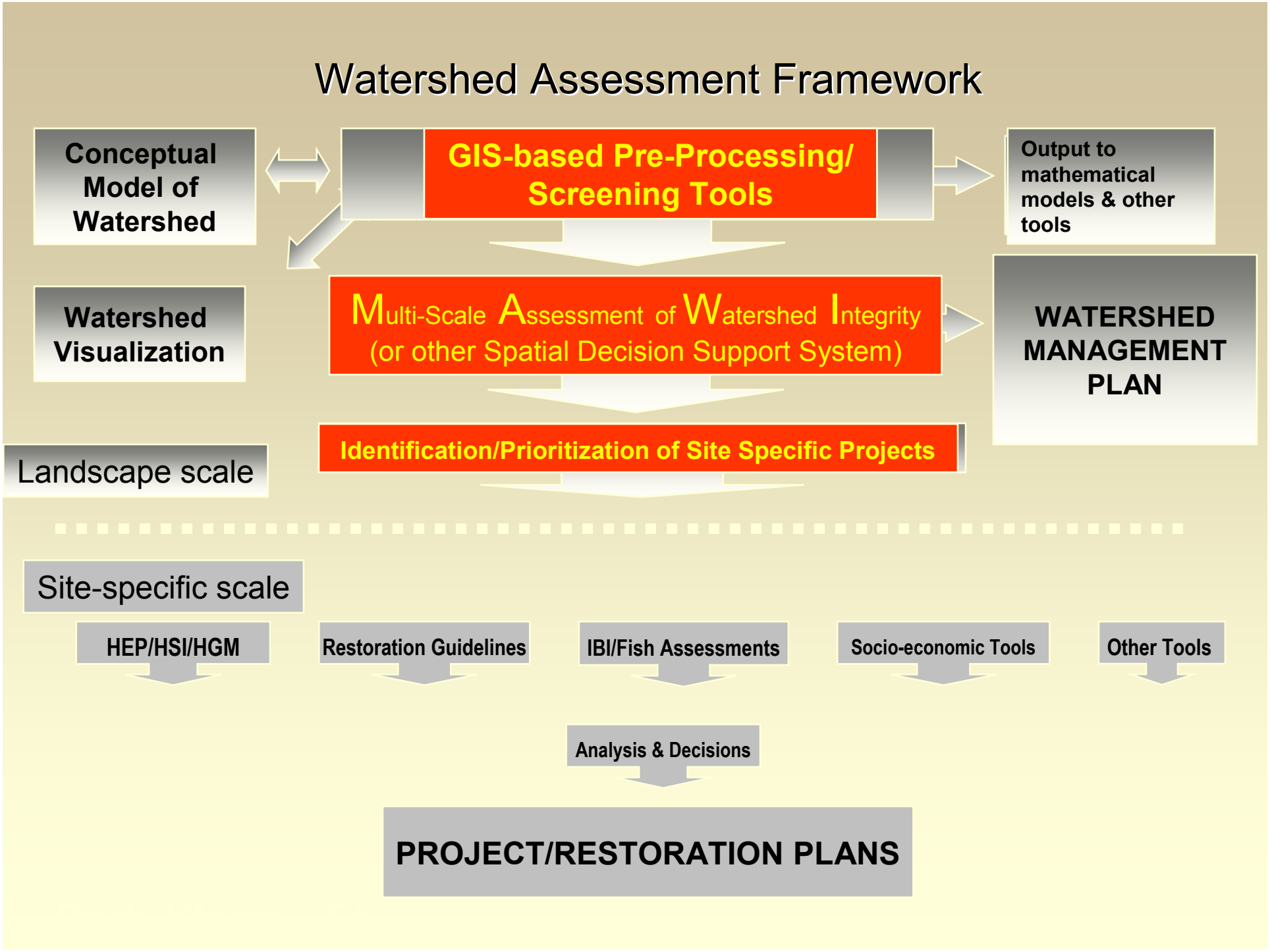
Submerged Aquatic Vegetation

Approaches are affected by fidelity and scale.

Conceptual model for water resource management

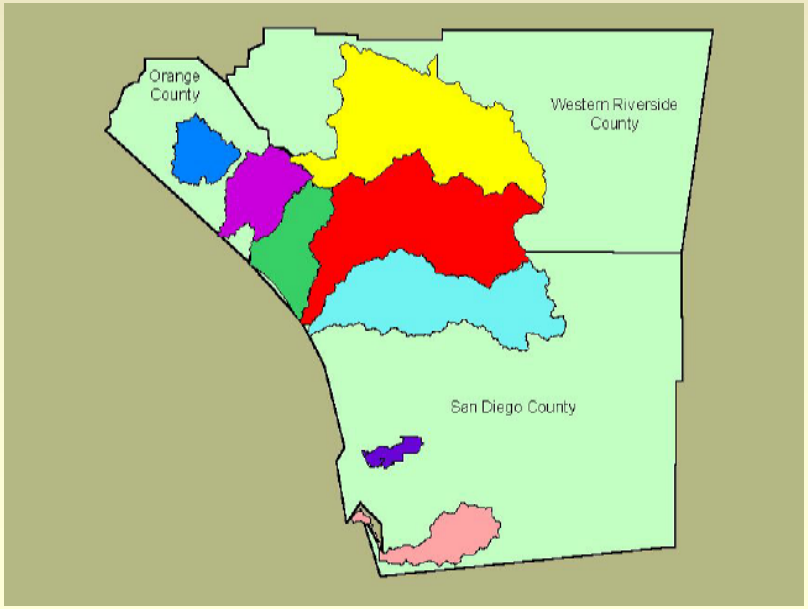


Watershed Assessment Framework



Geospatial Assessments

Dan Smith, EL
Barb Kleiss, EL
Bob Lichvar, CRREL
SPL - Regulatory



Project Objectives - Delineation

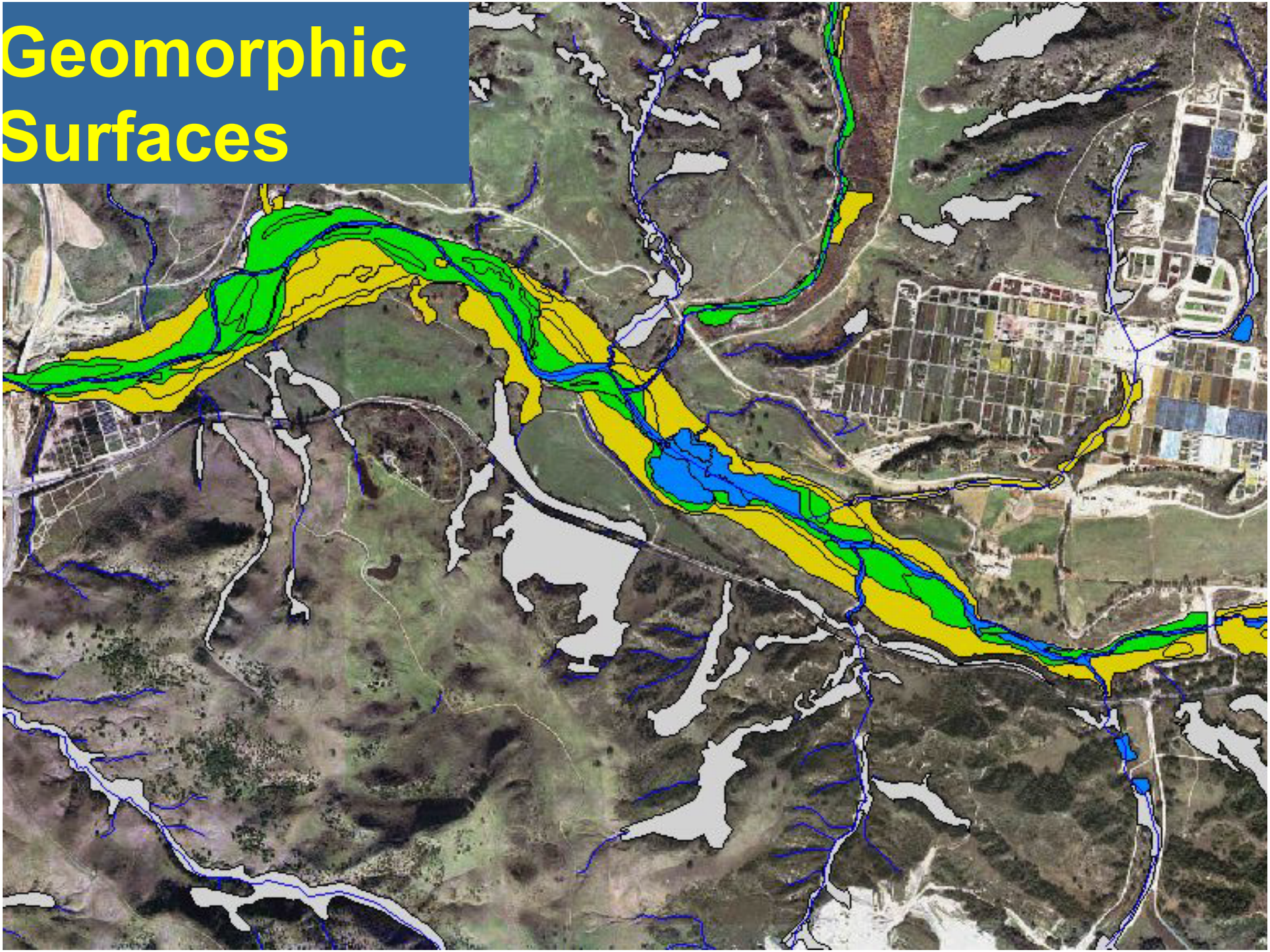
- Map non-wetland waters
- Map riparian ecosystems using geomorphic surface and vegetation communities
- Correlate hydrology, soils, and hydrophytic vegetation to geomorphic surfaces
- Develop ratings for riparian ecosystems that define the likelihood of WoUS occurring

Approach

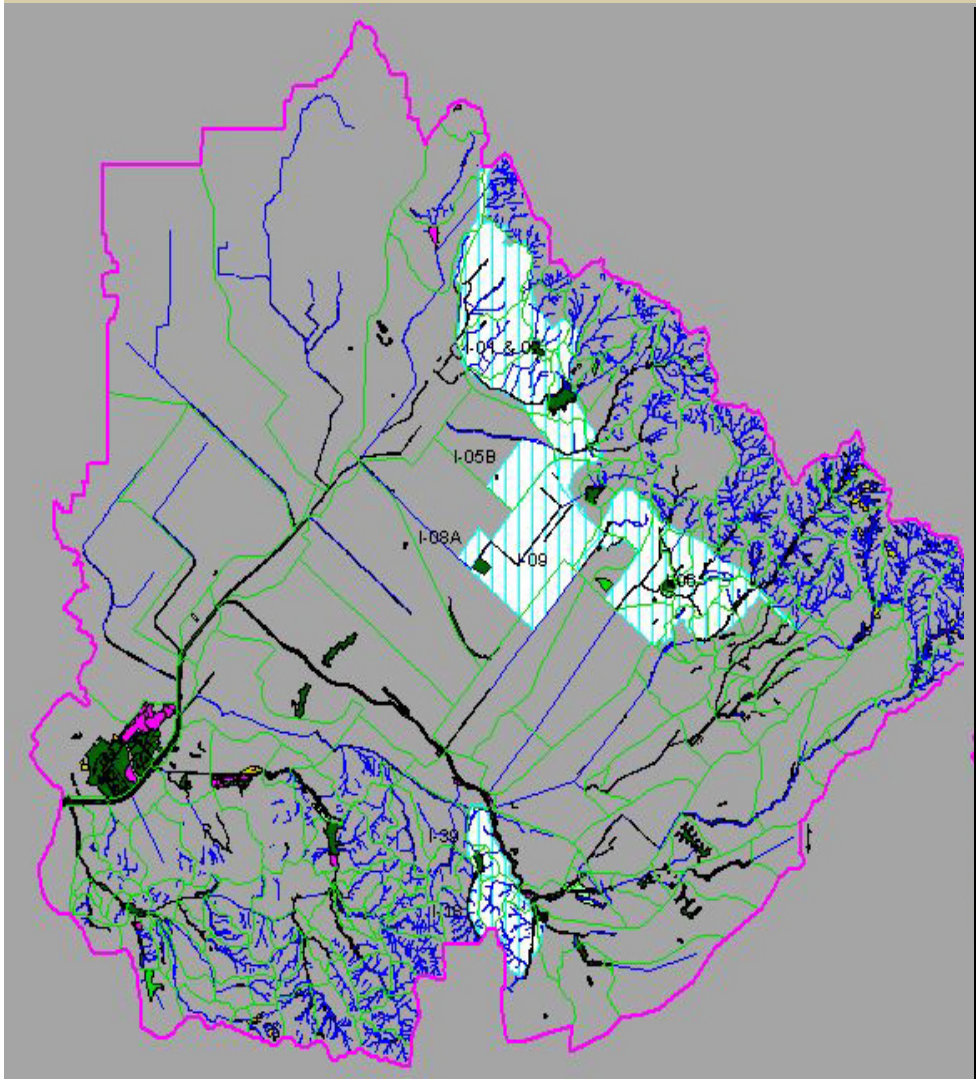
- Indicator Scores and Indices
  - Indicator metric values were converted to a score based on an ordinal scale relationship between indicators and assessment endpoints established using field observation and judgment
  - Selected indicator scores were summed to give hydrologic, water quality and habitat integrity indices

Indicator Metric Value Range	Score
<5% of main stem channel disconnected from the floodplain	5
>5 and <15% of main stem channel disconnected from the floodplain	4
>15 and <30% of main stem channel disconnected from the floodplain	3
>30 and <50% of main stem channel disconnected from the floodplain	2
>50% of main stem channel disconnected from the floodplain	1

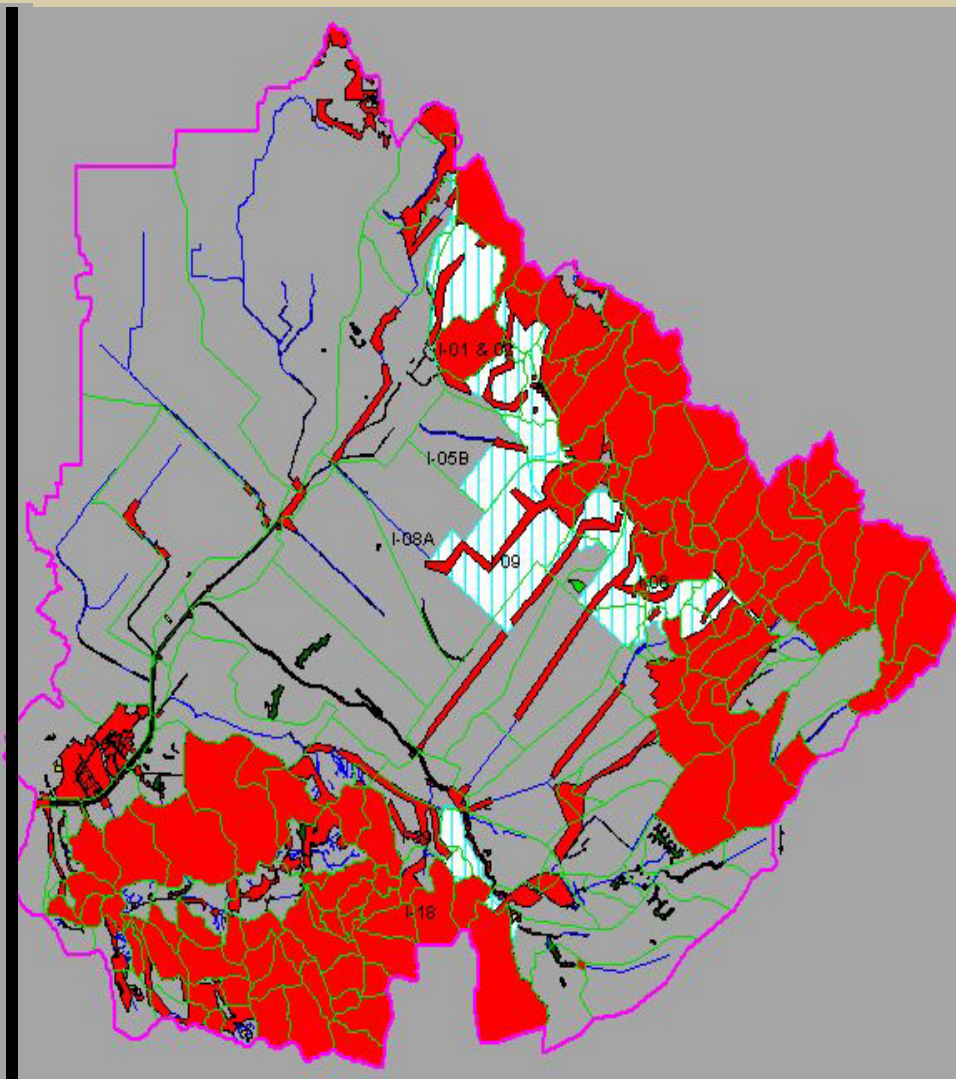
Geomorphic Surfaces



General Land Use Plan Alternative

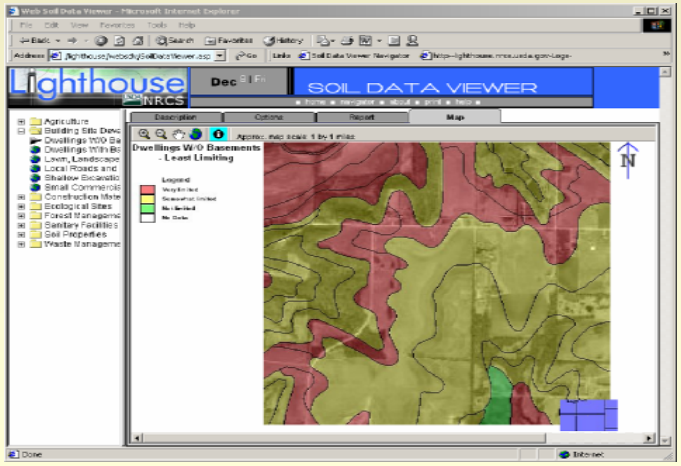


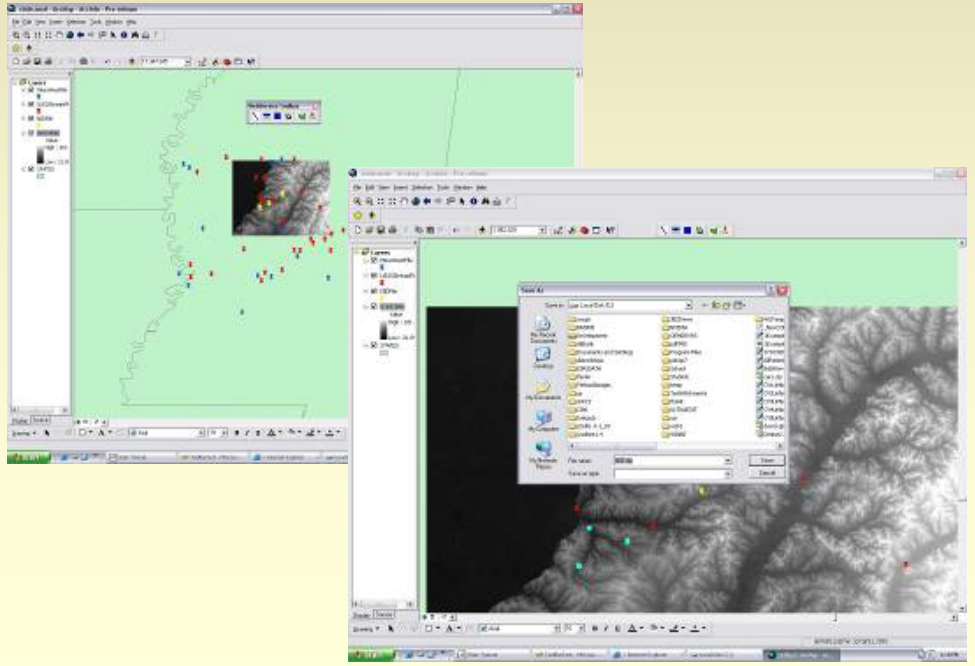
Selective Protection/Impact/Restoration Alternative



Geospatial Applications

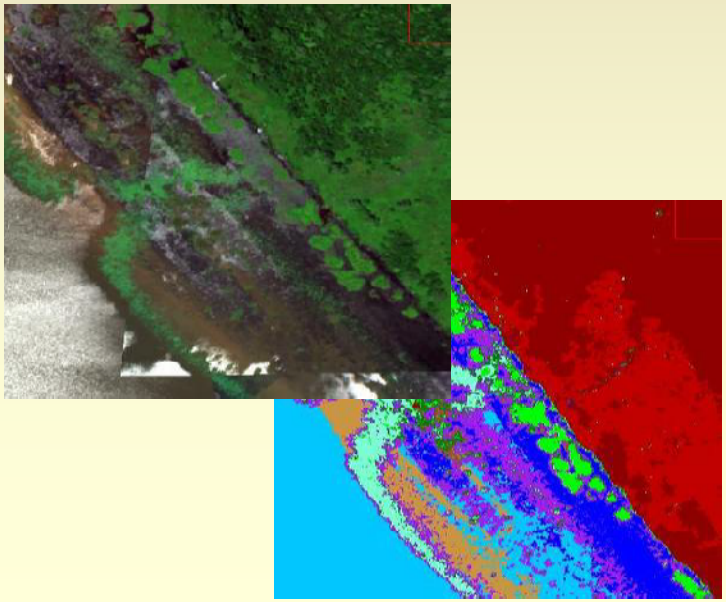
- Geospatial application design document: shows how individual GIS applications will be designed, engineered, and tested
- Geospatial application development: includes numerous applications that meet the specific requirements of the Pillars

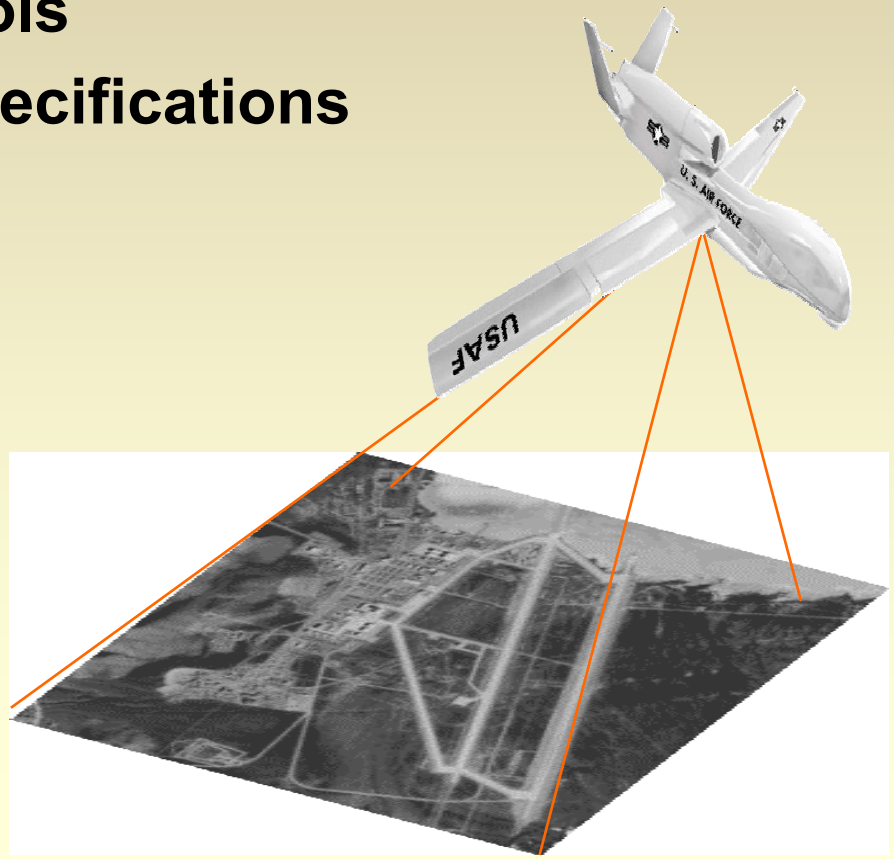




Regional Measurement & Monitoring

- RMM strategic operating procedures
- Data acquisition methodologies
- Data loading/QA/QC tools
- RMM guidelines and specifications





Minnesota River/Upper Miss

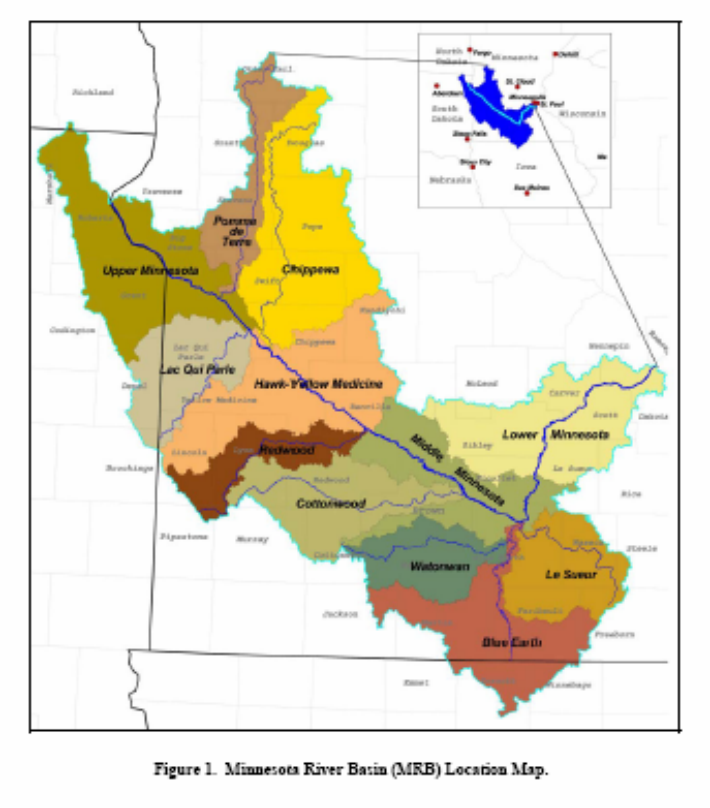
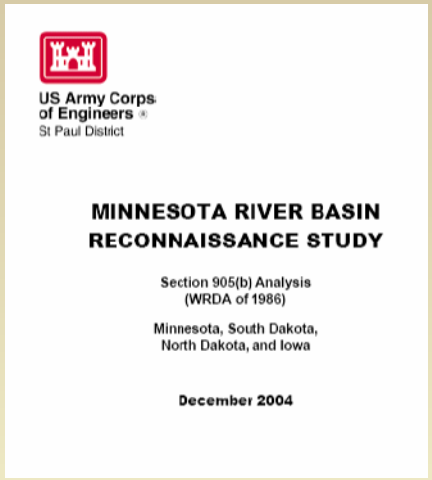


Figure 1. Minnesota River Basin (MRB) Location Map.


US Army Corps of Engineers
St Paul District

MINNESOTA RIVER BASIN RECONNAISSANCE STUDY

Section 905(b) Analysis
(WRDA of 1986)

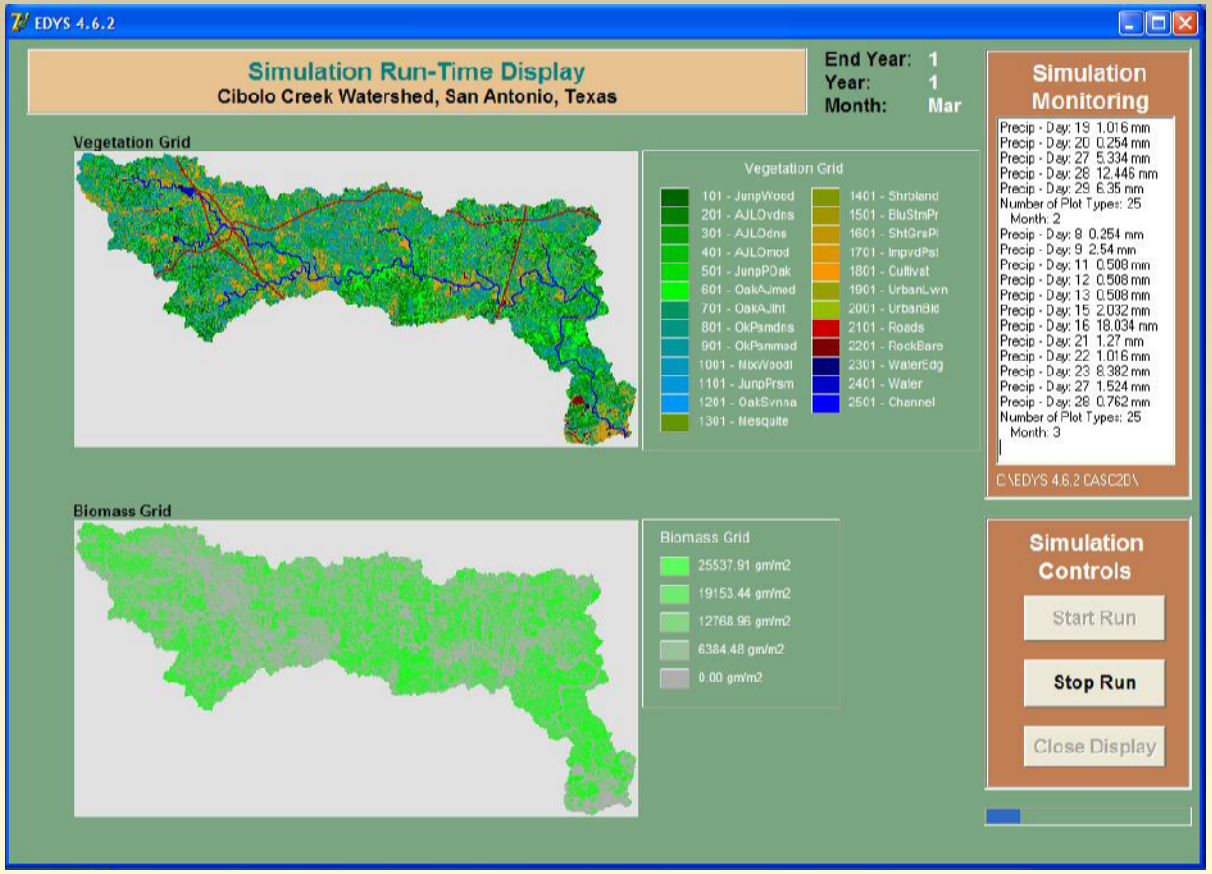
Minnesota, South Dakota,
North Dakota, and Iowa

December 2004

Issues
Land use changes associated with urban sprawl
Water quality and habitat degradation related to land use
Agricultural practices include tile drainage

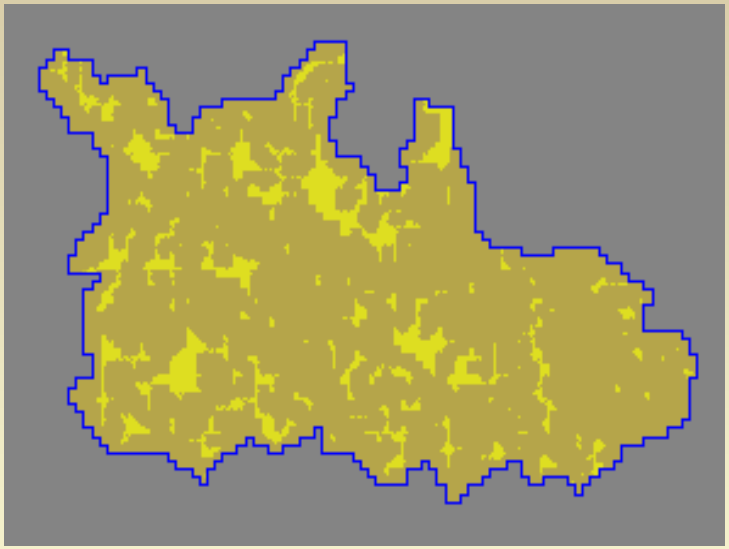
Approaches
Conceptual model – stakeholder involvement, goal setting
Watershed assessments – geospatial, runoff/loading
Landuse planning – decision support tools
River/reservoir response – CE-QUAL-W2

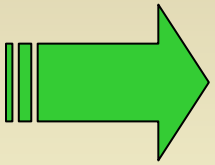
Watershed/Plant Interaction
GSSHA-EDYS Linkage

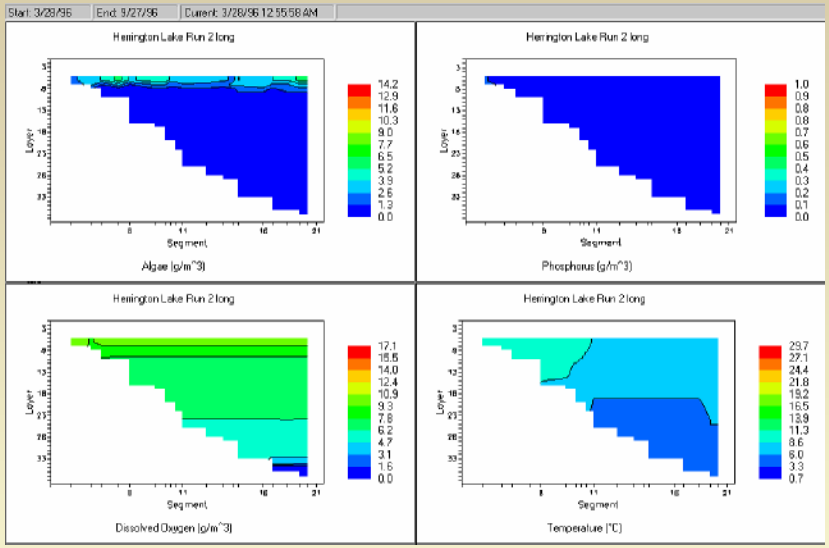


Vegetative uptake of water and nutrients interaction with surface and subsurface flow

Biological Response Modeling Example

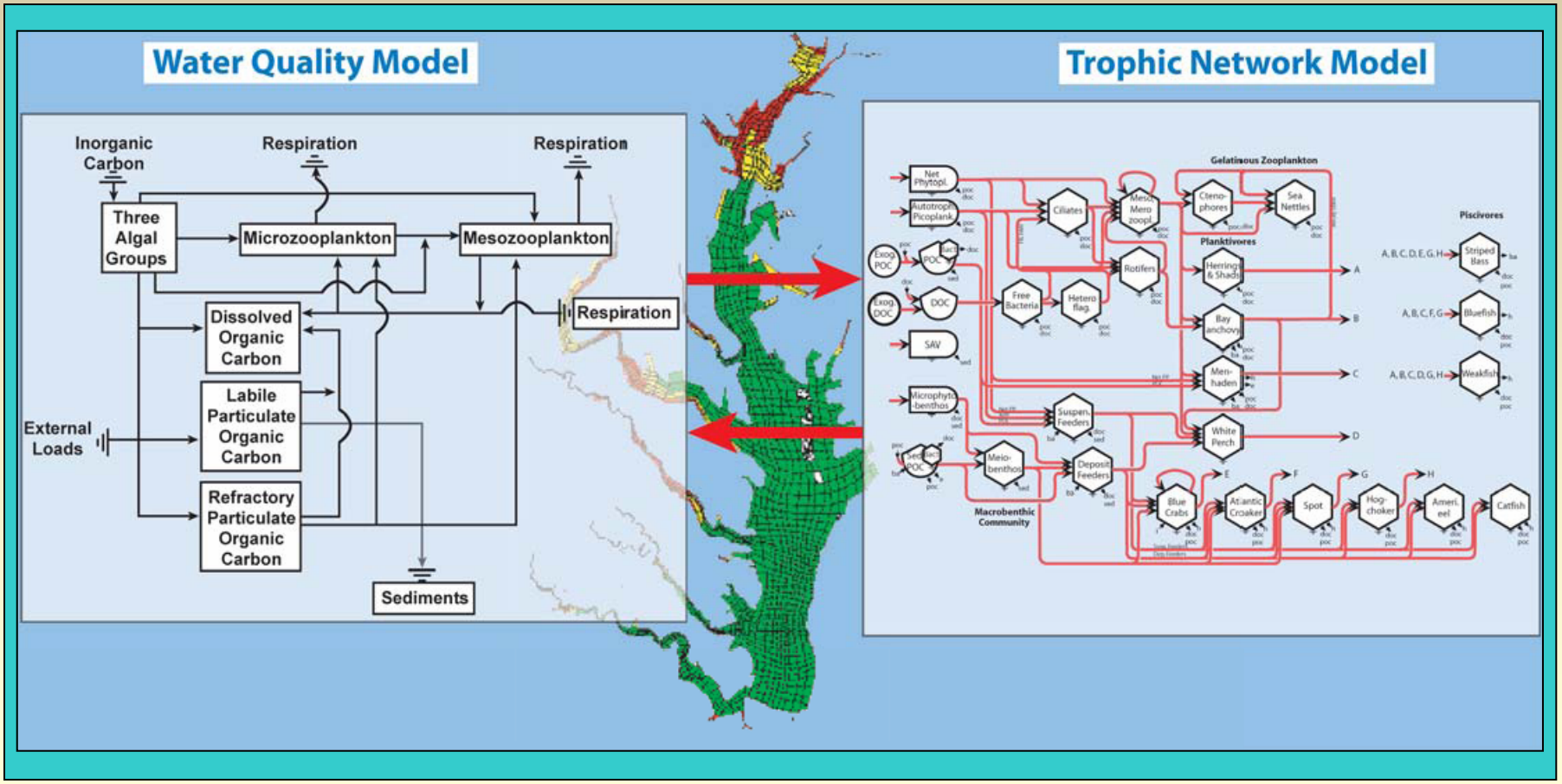


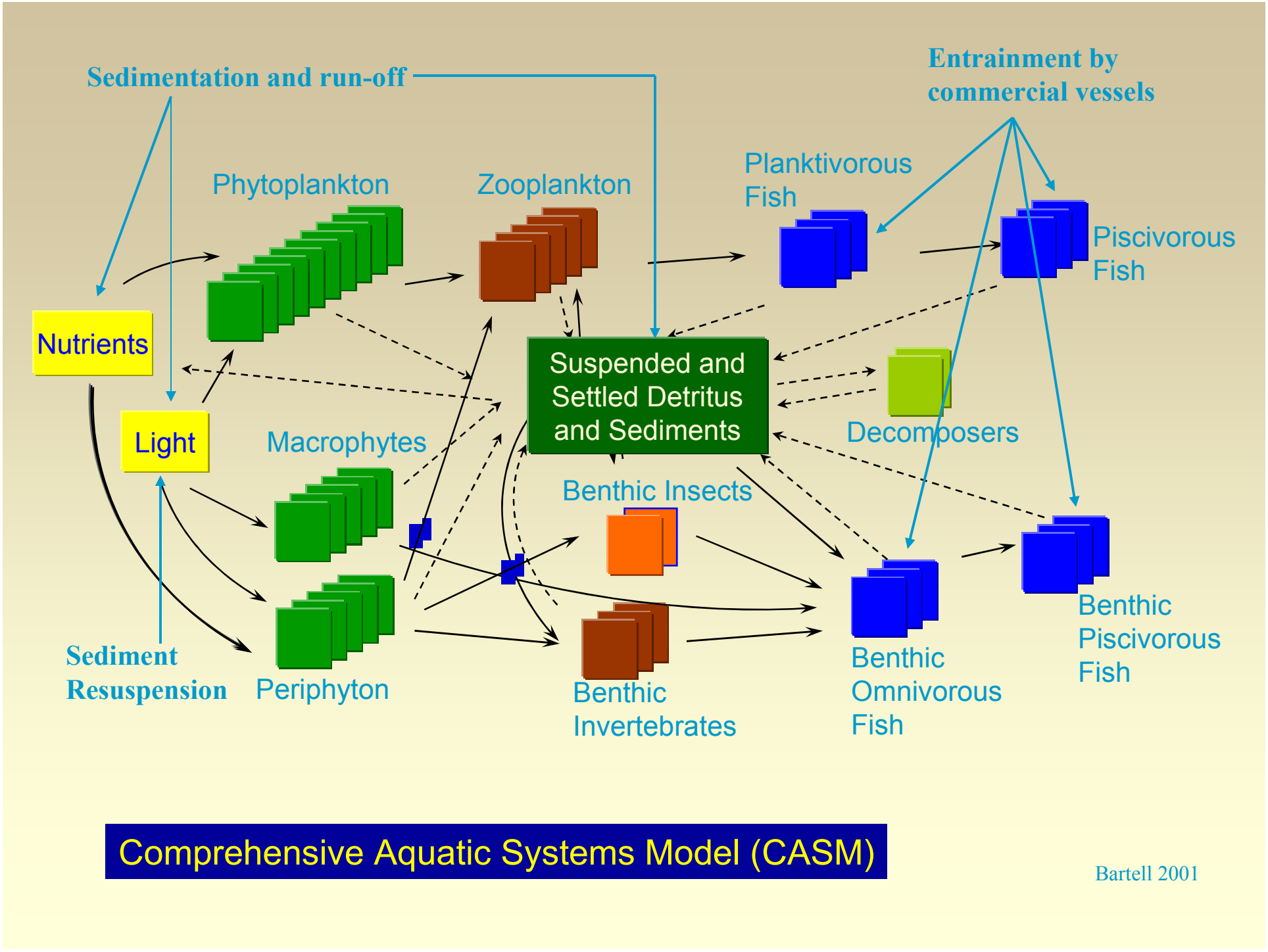




Coupled process based models (e.g., HMS/GSSHA and CEQUAL-W2) to forecast biological response to land use changes and water resources management

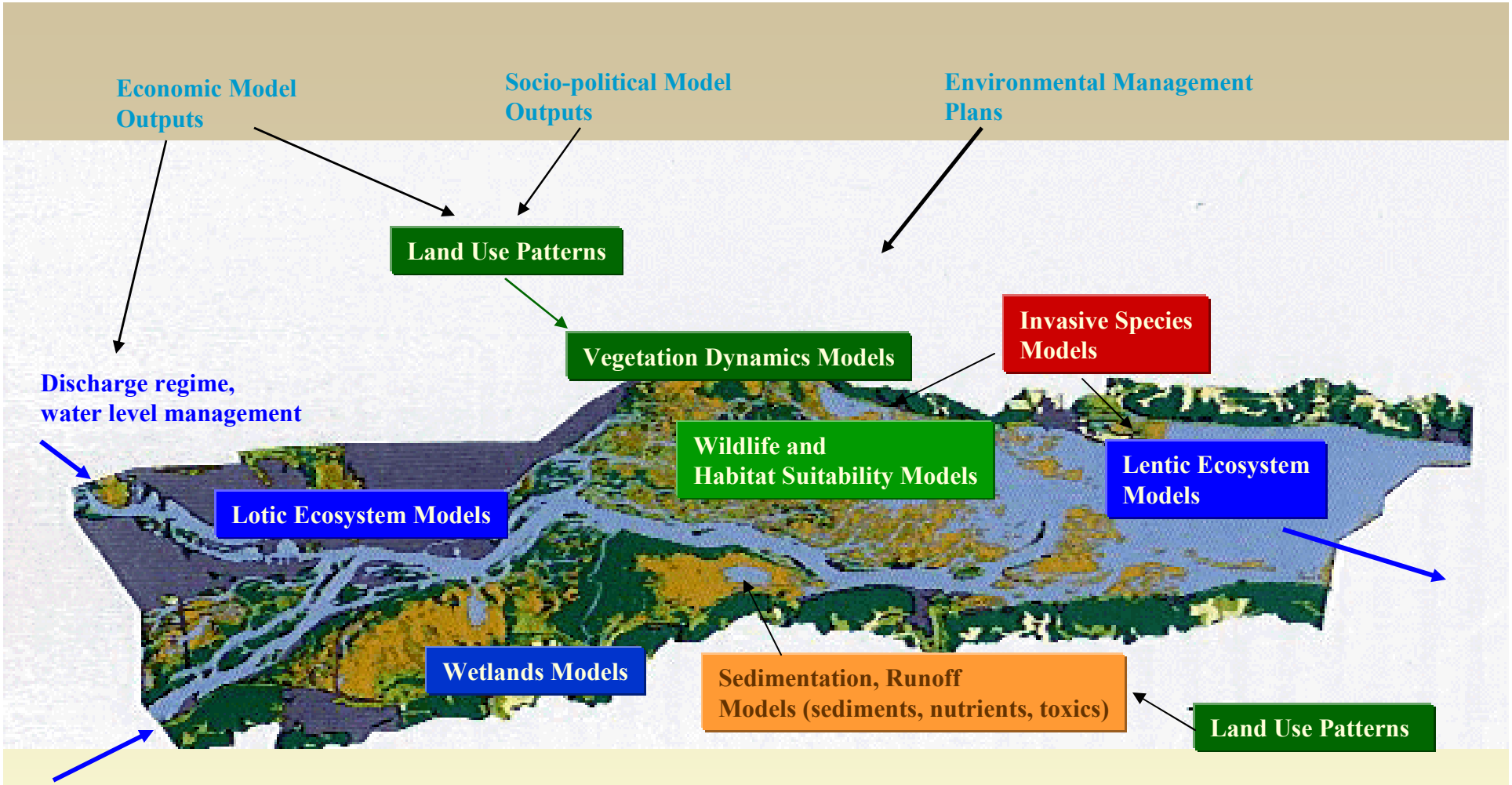
e.g., Coupling Ecological with Eutrophication Models





Comprehensive Aquatic Systems Model (CASM)

Bartell 2001



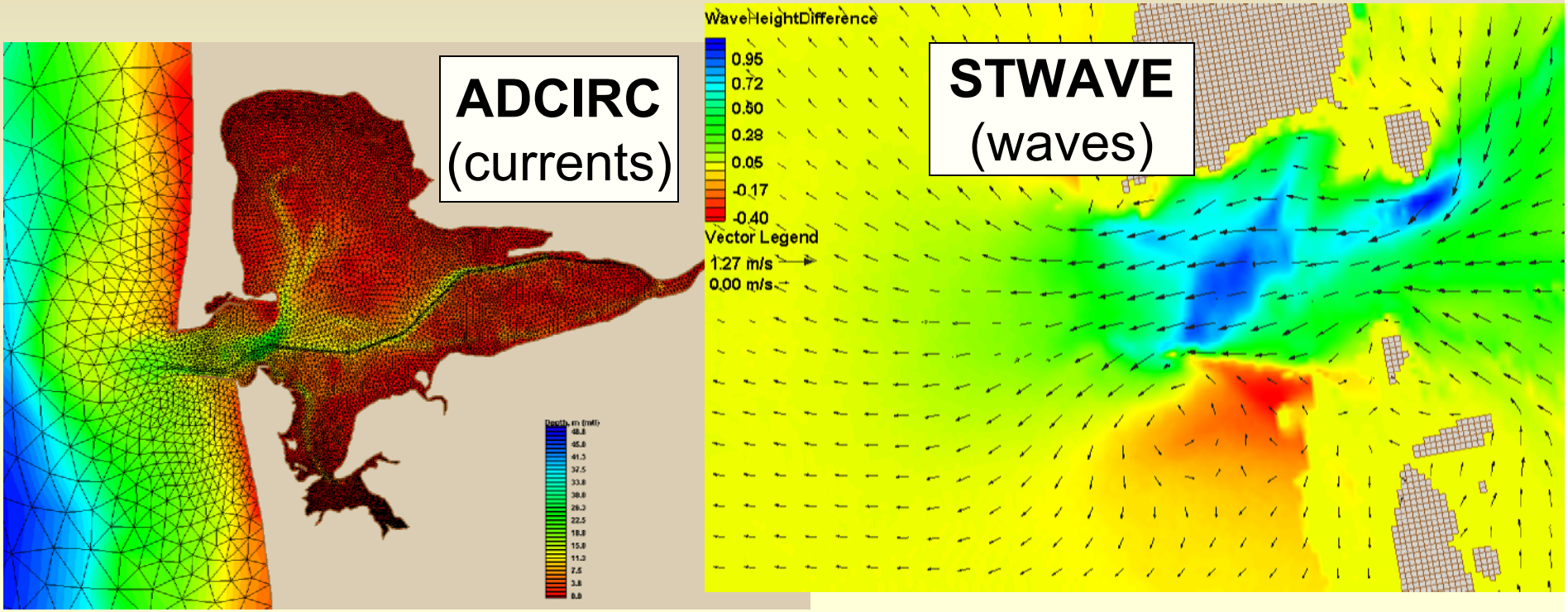
UMRS Environmental Conceptual Model

diverse set of ecological performance measures...

Bartell, 2001

Estuarine and Coastal Simulation

- Improved wave model (STWAVE)
- Improved coastal circulation models (ADCIRC & ADH)
- Integrated wave/current interaction environment



System-Wide Water Resources Program

Other District Interactions

MAWI (Barb Kleiss) – Onondaga Lake (LRB)
EFM (Chris Dunn) – Truckee River (SP)
GSSHA (Aaron Byrd) – Judy's Creek (MVR)
Ecological Response Modeling – (MVR)
Hyperspectral Imagery (Steve Wilhelms/Tim Pangburn)– Missouri River (NWO)

In the works

TMDL Assessment Toolkit
WAT
HMS
River Basin Morphology Modeling System
CASCADE
Coastal Morphology Modeling

https://swwrp.usace.army.mil