



Ecological and Environmental Modeling



- MODFLOW
- MOC
- FEMWATER
- FEMWASTE
- BLT
- GENII
- AIRDOS
- RESRAD

Representative Projects

USACE, St. Paul District

Spatially Explicit Decision Support Model Development for the Evaluation of the Success of Upper Mississippi River Ecosystem Restoration

E2 is currently working with the St. Paul District of the US Army Corps of Engineers (USACE) to develop a spatially explicit model for the evaluation of the successes of the Upper Mississippi River ecosystem restoration. The model implements a landscape version of the Comprehensive Aquatic System Model (CASM LANDSCAPE). The model integrates information on vegetation, land-use changes, aquatic systems, food webs, invasive species, water quality, hydrology, and other related environmental variables for assessing ecosystem management alternatives.

Cost-Benefit-Risk Analysis for Lock and Dam 3

High water velocities and the configuration of the Upper Mississippi River waterway at the approach to Lock and Dam 3 had caused several navigational accidents that resulted in human injuries, damages to the infrastructure, and environmental impacts. E2 developed an

E2 Consulting Engineers, Inc. (E2) offers more than 20 years of professional experience in the development, application, and evaluation of mathematical and computer simulation models used in support of the environmental sciences. E2 also provides modeling capabilities for human health and ecological risk assessments, decision analysis, adaptive environmental management, air dispersion modeling, groundwater flow and transport modeling, and uncertainty analyses. E2 specializes in developing customized modeling software for ecological and environmental applications.

Computer Modeling Expertise

E2 has demonstrated experience in ecological modeling, including population, community, ecosystem, and landscape models.

E2 is also skilled in the use of screening-level and detailed fate and transport and dose assessment models including:



interactive decision support software application to perform cost-benefit-risk analysis for engineering alternatives proposed by the USACE to reduce the adverse effects of high river velocities on commercial navigation at the Lock and Dam 3 site. The software included the capability to quantitatively define and



propagate uncertainties in the values of input parameters within a Monte Carlo framework. The sensitivity analyses identified parameters that contributed most to variability in the assessment results.

Risk-Based Decision Model for Managing Invasive Mussels in the St. Croix Basin

E2 worked with the St. Paul District and the Engineering Research and Development Center (Vicksburg, MS) of USACE and the URS Corporation to develop a spatially explicit model that assesses the efficacy of alternative management actions aimed at controlling the spread of invasive mussels (e.g., zebra, quagga) throughout the St. Croix River Basin



Invasive Mussels from St. Croix River Basin

(WI, MN), including Navigation Pools 2-4 on the Upper Mississippi River. The spatial model evaluates the proximity of the non-infested water body (lake, river segment, stream segment, navigation pool) to infested surface waters within the Basin, and addresses the spatial-temporal patterns of use by commercial vessels (navigation pools) and recreational boating. The model also includes 13 habitat suitability factors that determine the probability that introduced zebra or quagga mussels will establish self-reproducing populations.

Ecological Resource Modeling for the Mississippi River Headwaters Reservoir Operating Plan Evaluation

Historic operating practices produced periods of unnaturally high or low water elevations and/or flows that can negatively impact the quality and distribution of valued habitat (e.g., sedge meadows, and other wetlands) and the population sizes of fish, aquatic vegetation, waterfowl, shorebirds, and riparian mammals. E2 developed ecological models used to define water level flows and elevations that were more favorable to valued ecological resources in support of the Reservoir Operating Plan Evaluation.

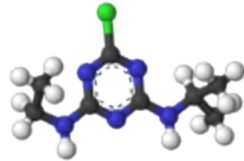




Syngenta Crop Protection

Modeling Ecological Risks Posed by Atrazine: A Generic Implementation of the Comprehensive Aquatic System Model for Midwestern Streams

The Comprehensive Aquatic System Model (CASM) was used to simulate an aquatic food web for a generic Midwestern 2nd or 3rd-order stream. E2 developed this aquatic ecosystem risk assessment model using available toxicity data and results of experimental studies to characterize exposures of concern for atrazine. The CASM describes the daily biomass (carbon) production of modeled populations of aquatic plants and animals as complex, nonlinear functions of fluctuating environmental conditions (e.g., light, temperature, nutrients), time-varying ecological conditions (e.g., competition within trophic guilds, grazing, predator-prey interactions), and population-specific sensitivities to atrazine exposure. This project produced a framework for evaluating site-specific atrazine monitoring data in relation to decision criteria derived from the integration of the CASM results with existing micro- and mesocosm studies.

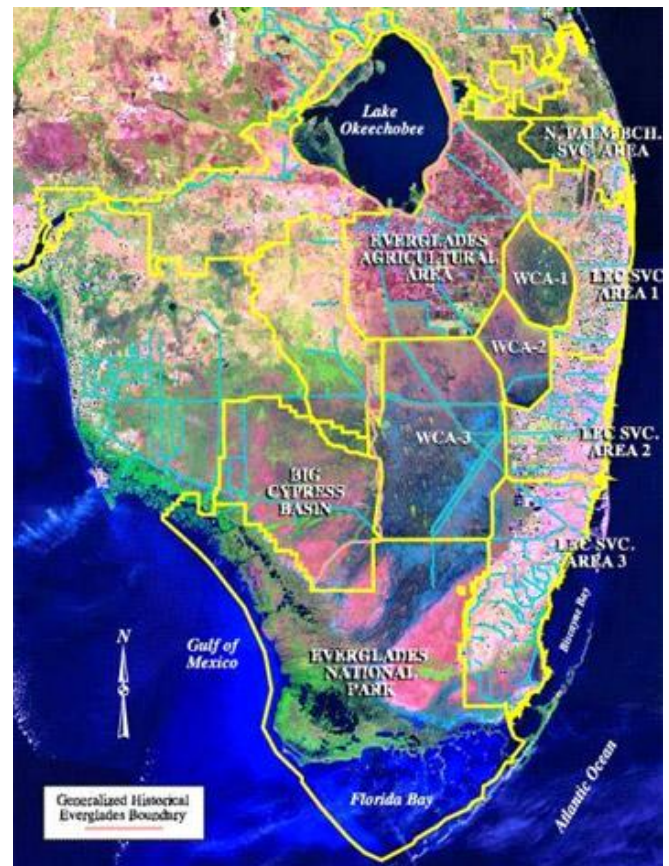


E2 also developed a risk-based decision framework that addressed ecological impacts of various environmental stressors. Methods of numerical sensitivity and uncertainty analyses were implemented as part of the decision model to identify the key sources of uncertainty in decision model results. This information was used to identify critical gaps in information and effectively allocate resources for additional studies.

Everglades National Park, US Department of Interior

Technical Advisory Services for the Florida Bay Salinity-Based Performance Measures Project

E2 collaborated with Everglades National Park (ENP) managers and decision-makers to identify specific management and restoration activities (e.g., water level manipulation, wetland restoration, controlled fires, etc.) that are feasible and practical (i.e., cost effective) in relation to restoration of the Park.



Land Cover Data from SPOT Satellite Classification