

COASTAL ZONE GIS DATABASE DEVELOPMENT, VISUALIZATION AND DISTRIBUTION IN THE GREAT LAKES - THE LAKE MICHIGAN POTENTIAL DAMAGES STUDY AND THE LOWER GREAT LAKES EROSION STUDY

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INTRODUCTION

In 1997, the Detroit District of the U.S. Army Corps of Engineers initiated an extensive and long-term assessment of potential shoreline flood and erosion damages over the next 50 years due to fluctuating lake levels along the Lake Michigan shoreline. The study, known as the Lake Michigan Potential Damages Study (LMPDS), is dedicated to meeting several of the recommendations that came out of the 1986-1993 IJC Great Lakes Levels Reference Study (International Joint Commission, 1993), in particular to "objectively assess the economic value of all shoreline interests in terms of "potential damages" that could occur under differing hydrologic conditions, or alternate management approaches to lake level controls."

In 1998, taking their cue from work carried out in the LMPDS, the Buffalo District of the U.S. Army Corps of Engineers began the Lower Great Lakes Erosion Study, with the key first-year objective of developing shoreline classification, recession rate, land use and land use trend databases for the U.S. shorelines of Lake Ontario and Lake Erie (see Eberhardt and Bender, 2001, this proceedings). These databases are proposed to be the foundation for a lake-wide shoreline erosion modeling system that will be used to anticipate future shoreline erosion potential based on given future climate and water level scenarios. The system may ultimately be used to address issues related to lake level control, coastal zone management (CZM), and site specific designs.

DATA COLLECTION

A wealth of information has been collected for these studies including kilometer-by-kilometer data on recession rates, land use, land use trends, shore type (geology), type and quality of shore protection, offshore geology, and bluff characteristics. Efforts have also included the development of continuous GIS data coverages in Arc/Info and ArcView along these coasts, particularly for the type and quality of shore protection, shoreline type, offshore geology and recession rates.

DATA VISUALIZATION AND MODELLING

Data being collected is being fed into a number of modeling tools for analysis and visualization that are being developed including a *Recession Rate Analysis System* - a relational database and GIS mapping system - and a *Flood and Erosion Prediction System* - a modular based system developed in Arc View. The data is being used to assist in the evaluation of potential flood and erosion damages along the Lake Michigan

coastline and to evaluate the response of different shore types to changing water levels on Lake Erie and Lake Ontario.

Recession Rate Analysis System (RRA)

To manage the wealth of data collected through the above activities and to be able to conduct some preliminary analyses of recession rate, land use and other data, we have created a Recession Rate Analysis System (RRA), which is an expert system designed to undertake priority determinations for recession rate data and to serve as a vehicle for cataloguing, monitoring and updating the entire database of related information (e.g., reach, land use, land use trend, etc.) (see Stewart 1999a and b).

The RRA is a flexible and customizable system that integrates a powerful relational database management system (MS FoxPro) with a dedicated Geographic Information System mapping and visualization package (QuikMap) that will allow basic mapping and visualization of all query results (Figure 1).

The RRA system is a “living system” in that, a complete copy of it, with the data collected for the project is provided to the client along with any associated reports and "hard copy" data appendices. This can then be used by the client to run additional queries, and undertake additional recession rate assessments as new data becomes available, or as various data sets become revised (e.g., land use, shoreline classification).



Figure 1 - The Recession Rate Analysis System

The Flood and Erosion Prediction System (FEPS)

As part of the Lake Michigan Potential Damages Study being carried out by the U.S. Army Corps of Engineers - Detroit District, a Flood and Erosion Prediction System (FEPS) is being developed by Baird & Associates (Nairn and Zuzek, 2001, this

proceedings) in order to predict potential flood and erosion damages associated with possible future hydrologic scenarios. FEPS includes: a coastal data base, graphical user interface, data processing and analysis tools, a 2D coastal process model, and custom ArcView GIS tools (Figure 2). It is a loosely coupled system developed with Visual C++ and Avenue (ArcView) and has links to various numerical models including those for cross-shore profile determination and wave run-up. The system allows users to create "projects" for studying any specified section of shoreline using the built-in data and coastal process modeling tools.

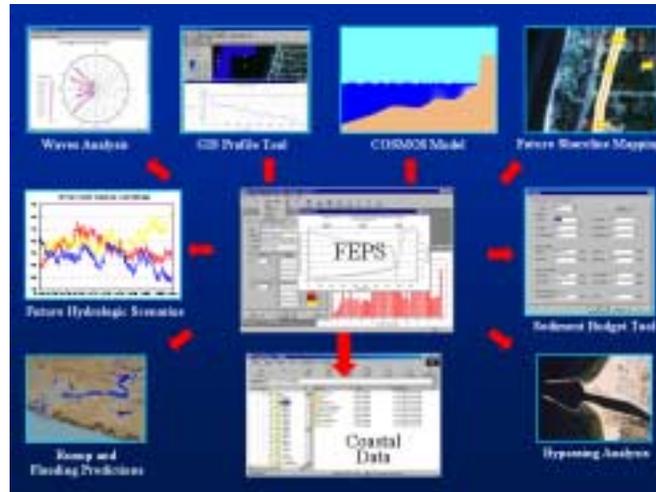


Figure 2 - The Flood and Erosion Prediction System.

DATA DISTRIBUTION AND FUTURE USE

Data and information generated in both the Lake Michigan Potential Damages Study and the Lower Great Lakes Erosion Study are currently being distributed via document and data clearinghouses on the web sites for these studies which can be found at:

Lake Michigan Potential Damages Study
<http://huron.lre.usace.army.mil/coastal/LMPDS>

Lower Great Lakes Erosion Study
<http://www.cjscons.com/LGLES>

Discussions are also underway to distribute and serve the data through the Internet via more robust and comprehensive, on-line document, GIS, multi-media and data distribution applications. An example of such a system is the Zambezi River Wetlands Information System (Z-WIMS), which is an Internet and CD-ROM based mapping and multi-media information system designed for IUCN (The World Conservation Union). The system allows users such as project managers, funding agencies, stakeholders and the public, to easily query the extensive database and view IUCN activities across the entire Zambezi River Basin in Southern Africa. Users can select to view interactive web maps, videos, photographs, reports, articles and newsletters, all relating to work in the Zambezi

River Basin of Southern Africa. In both the Internet and CD-ROM versions, the query interface is located in a frame on the left of the screen, while the query results are displayed in a browser on the right hand of the screen (Figure 3). Details on the background and impetus behind ZWIMS can be found in Law et al., 1999.



Figure 3 - Z-WIMS Internet Browser (left) and CD-ROM Browser (right).

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