



RESEARCH SERVICES SECTION

TECHNICAL SUMMARY

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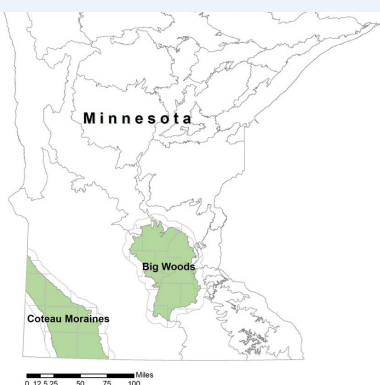
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Principal Investigator:

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PROJECT COST:

\$54,046



Researchers tested the new toolbox on two ecological subsections: Big Woods and Coteau Moraines.

Improving the Predictive Accuracy of Mn/Model: Modeling Historic and Prehistoric Surface Water Features

What Was the Need?

Mn/Model, an archaeological predictive model developed by Mn/DOT in the late 1990s, applies spatial analysis over large areas to determine the probability of finding precontact archaeological sites and to assess the need for archaeological surveys. The model is used for Section 106 reviews of Mn/DOT projects, helping to decide which areas to avoid and which to survey, as well as providing valuable information for survey design. It also helps Mn/DOT to avoid impacts on archaeological sites and to save money on unnecessary surveys.

Researchers noted that while Mn/Model has worked well using modern lake, river and wetland location information, its analyses have for the most part left out historic and prehistoric surface water features. Modern water features are in some cases the result of human impacts on the landscape; many historic lakes and wetlands, for instance, have been drained. Abandoned channels represent historic or prehistoric drainage patterns.

Given the significance of water features in predicting the location of archaeological sites, information on historic and prehistoric water features can greatly improve Mn/Model's predictive accuracy, particularly in parts of Minnesota where water features have changed dramatically over the past 10,000 years.

What Was Our Goal?

The goal of this study was to develop a method for mapping historic and prehistoric surface water features from readily available geographic information system data and test it on two Ecological Classification System subsections of Minnesota. Further, investigators aimed to create an automated tool that can be used to model historic and prehistoric surface water features in other parts of the state.

What Did We Do?

First, researchers identified appropriate data sources and developed a methodology to model now-absent water features. Soils are excellent indicators of past wet environments, particularly in areas that have been artificially drained; county soils data sets (Soil Survey Geographic data from the Natural Resources Conservation Service) were used as the primary input. Additional inputs came from the National Wetlands Inventory; Minnesota Department of Natural Resources surface water features; General Land Office surveyor's plat maps; and high-resolution landform sediment assemblage data, where available, that was developed for Mn/Model.

For the purposes of this study, modern water features are those found in NWI and Mn/DNR data; historic surface water features were defined as modeled water features found on GLO survey plat maps; and prehistoric surface water features were defined as any modeled water feature not recorded in GLO or modern data.

In the second phase of the project, researchers tested their new model on the Big Woods ecological subsection of Minnesota. They then analyzed another subsection, Coteau Moraines, to refine the model for use in other areas.

Finally, researchers automated the model to generate a GIS surface water features layer that reflects historic and prehistoric water features. This was implemented in ESRI ArcInfo 9.2 (ESRI 2005) and built using ArcGIS ModelBuilder.

“The new Historic Water Features Tools make Mn/Model more accurate by identifying locations of water bodies, such as drained lakes, that are not present in modern hydro-graphic data.”

–Elizabeth Hobbs,
State Program Admin-
istrator Coordinator/
Geographer, Cultural
Resources Unit, Mn/DOT
Office of Environmental
Services

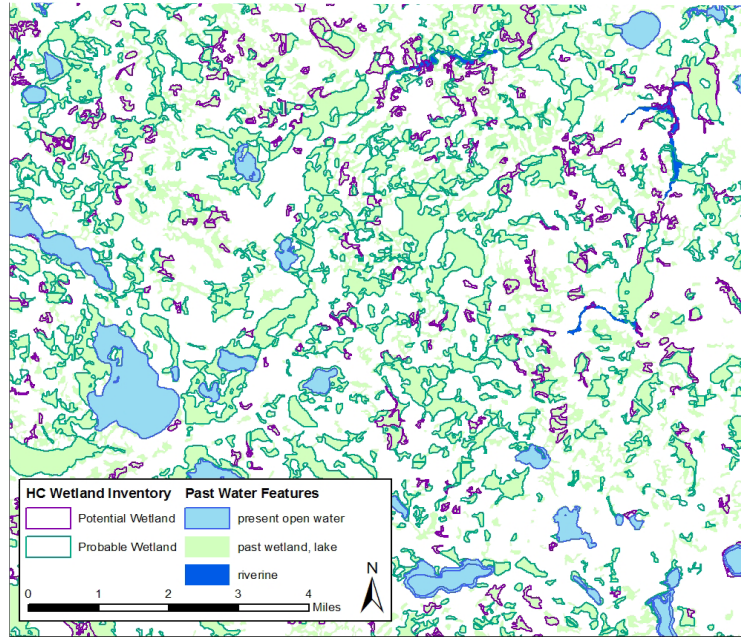
*“We expect that the
Historic Water Features
Tools, used together with
the results of Mn/Model
analyses, will greatly
improve planners’ confi-
dence in their predesign
reviews.”*

–Stacey L. Stark,
Director, University
of Minnesota-Duluth
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This GIS layer image, generated by the developed toolbox, is overlaid with the Hennepin Conservation District's restorable wetland inventory for Hennepin County. The new tool captured almost all of the HCD wetlands.

What Did We Learn?

Researchers created the ArcGIS Toolbox Historic Water Features Tools, a collection of four tools that together produce a new GIS layer of historic and prehistoric hydrography. Designed to be applied one county at a time, the new tools remove modern water features that are the result of human activities from the input data, and add historic and prehistoric water features. Each tool creates a GIS layer (a shapefile) that can be used separately or with the outputs from the other tools. The new toolbox includes:

- **Tool 1:** Identifies modern, historic and prehistoric lake, wetland and riverine features from soils data.
- **Tool 2:** Identifies the presence of GLO-surveyed lakes that appear as the output of Tool 1; Tool 2 is used only if GLO-surveyed lakes have been digitized.
- **Tool 3:** Adds water features from NWI data, removing artificial features; and incorporates data from the Restorable Depressional Wetland Inventory when it is available.
- **Tool 4:** Combines the output created from tools 1 through 3 with additional data from land-form sediment assemblages, where available, to create one shapefile of potential historic and prehistoric water features.

What's Next?

Mn/DOT plans further refinements to heighten the predictive value of the Historic Water Features Tools so that its results are more informative about the nature of the historic and prehistoric water features identified in the tools' output. Future plans also include the use of the hydro-graphic models in lieu of modern hydrography for improving Mn/Model's ability to predict the presence or absence of archaeological resources.

The toolbox and the reformatted soils data that serves as its primary input are available for use by other state agencies; please contact mnmodel@dot.state.mn.us for more information.

This Technical Summary pertains to Report 2008-13, "Methods to Incorporate Historic Surface Hydrology Layer in Mn/Model [Phase 4] Using Existing Geographic Information System Data," published May 2008. The full report can be accessed at <http://www.lrrb.org/PDF/200813.pdf>.