



# The Research Agenda of the Wisconsin Coastal Atlas

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*University of Wisconsin Sea Grant Institute*

International Coastal Atlas Network Workshop 4

*Trieste, Italy*

*Tuesday, November 17, 2009*

# Presentation Outline



- Background

- Wisconsin Coastal GIS Applications Project (1994-2009)

- Lessons Learned from Four Data Integration Projects

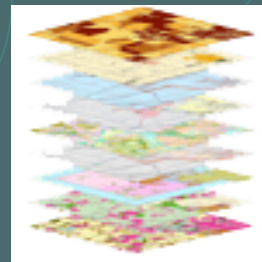
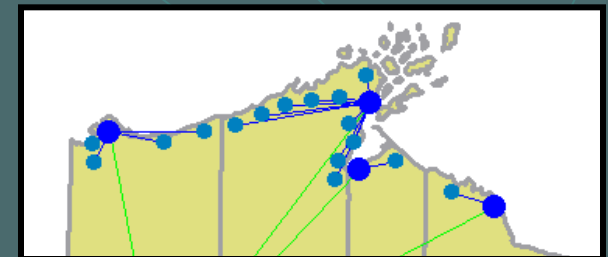
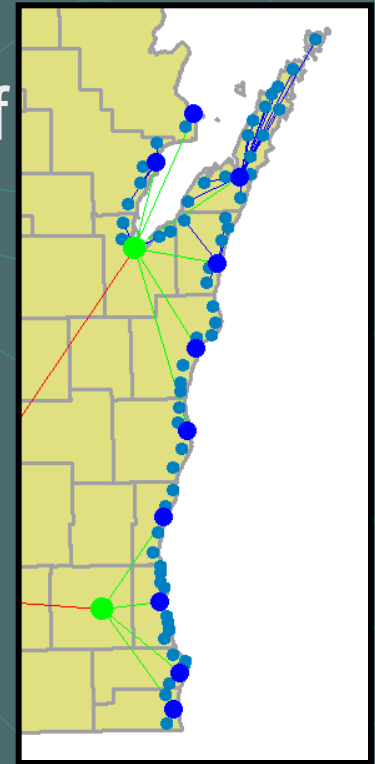
- The Research Agenda of the Wisconsin Coastal Atlas

# Where are we?



# WI Coastal GIS Applications Project

- The mission of the Wisconsin Coastal GIS Applications Project is to teach the application of GIS and related geospatial technologies to support sustainable use of Great Lakes coastal resources.
- The primary audience has been local, regional, and state government professionals.
- A Sea Grant/LICGF partnership started in 1994.



# Coastal GIS Conceptual Model

**PHASE 1**  
GIS TEACHING  
MODELS

Shoreland  
Management

Coastal  
Erosion

Water  
Quality

Other  
Coastal Issues

**PHASE 2**  
COMPREHENSIVE  
COASTAL GIS

Data  
Discovery

Data  
Acquisition

Data  
Integration

Spatial  
Analysis

**PHASE 3**  
DYNAMIC AND  
DISTRIBUTED GIS

Web  
Mapping

Geospatial  
Interoperability

Catalog Services  
for the Web

Open  
Archives

**PHASE 4**  
VISUALIZATION


3D  
Visualization

Animation

Data  
Visualization

Dashboard

# CGIS Project Timeline

- 
- 1994-96
    - Needs Assessment, Intro to Coastal GIS Training
  - 1996-98
    - GIS “Teaching Models”
  - 1998-00
    - Mobile GIS lab, LMPDS
  - 2000-02
    - Coastal Orthoserver, Map Server, 3D Visualization
  - 2002-04
    - LSCMP, Smart growth, Citizen-based land use planning
  - 2004-06
    - Coastal visualization, Interoperability
  - 2006-08
    - WFS, PSS, Hydrologic Dashboard, GLOS

Phase 1



Phase 2



Phase 3



Phase 4



# Coastal Data Integration Projects

- Lake Michigan Potential Damages Study (98-00)
  - Funded by U.S. Army Corps of Engineers
- Lake Superior Coastal Mapping Portal (02-04)
  - Funded by NOAA Coastal Services Center
- Wisconsin Coastal Guide (05-07)
  - Funded by Wisconsin Coastal Management Program
- Wisconsin Coastal Data Catalog (08)
  - Collaboration with Puneet Kishor and Sam Batzli

# Lake Michigan Potential Damages Study



As part of a Corps of Engineers' project to assess potential damage along Lake Michigan arising from varying lake levels, digital spatial data including parcels, base maps, orthophotos, land use/land cover, and soils were acquired and integrated for coastal counties and cities in Wisconsin.



# Assessed Value of the Coast


## Assessed Value of Parcels that Intersect the 1000' Jurisdiction Stipulated in State Shoreland Zoning Regulations (NR115)

Study Unit	Land Value	Improvement Value	Total Value
Marinette County <sup>1</sup>	33,230,950	73,506,600	\$ 106,737,550
Oconto County	\$ 17,715,600	\$ 20,575,100	\$ 38,290,700
Brown County	parcels as lines	parcels as lines	parcels as lines
Door County	\$ 993,054,820	\$ 908,584,360	\$ 1,901,639,180
Kewaunee County	\$ 32,691,220	\$ 70,433,430	\$ 103,124,650
Manitowoc County	no local hydro	no local hydro	no local hydro
City of Two Rivers	parcels as lines	parcels as lines	parcels as lines
City of Manitowoc	\$ 16,440,400	\$ 70,568,600	\$ 87,009,000
Sheboygan County	\$ 62,669,016	\$ 53,410,850	\$ 116,079,866
City of Sheboygan	parcels as lines	parcels as lines	parcels as lines
Ozaukee County	parcels as lines	parcels as lines	parcels as lines
Milwaukee County	no tax roll received	no tax roll received	no tax roll received
City of Milwaukee	parcels as lines	parcels as lines	parcels as lines
Racine County <sup>2</sup>	\$ 7,535,700	\$ 17,694,400	\$ 25,230,100
Kenosha County	\$ 75,868,100	\$ 176,258,500	\$ 252,126,600
<b>Totals</b>	<b>\$ 1,239,205,806</b>	<b>\$ 1,391,031,840</b>	<b>\$ 2,630,237,646</b>

<sup>1</sup>Figures for Marinette County include only the Town of Peshtigo.

<sup>2</sup>Gaps exist in the local hydro representation of the Lake Michigan shore.

# Issues: Digital Parcel Integration

- 
- Data Acquisition Issues (primarily institutional)
    - Number of contact points for data requests
    - Cost of data acquisition
    - Time required to receive data after the request is made
    - Restrictions placed on the use and dissemination of digital data
  - Data Integration Issues (primarily technical)
    - Media, file size, documentation, software format, map tiles, compilation methods, coordinate systems, data structure, parcel map/tax assessment data linkage



# LMPDS Lessons

- When finished, we had an integrated data base
- The same data sets are used over and over again in coastal analyses
- Can address issues of regional concern
- But... information quickly goes out of date, much effort and cost to keep current
- Researchers and outreach specialists aren't very good spatial data librarians

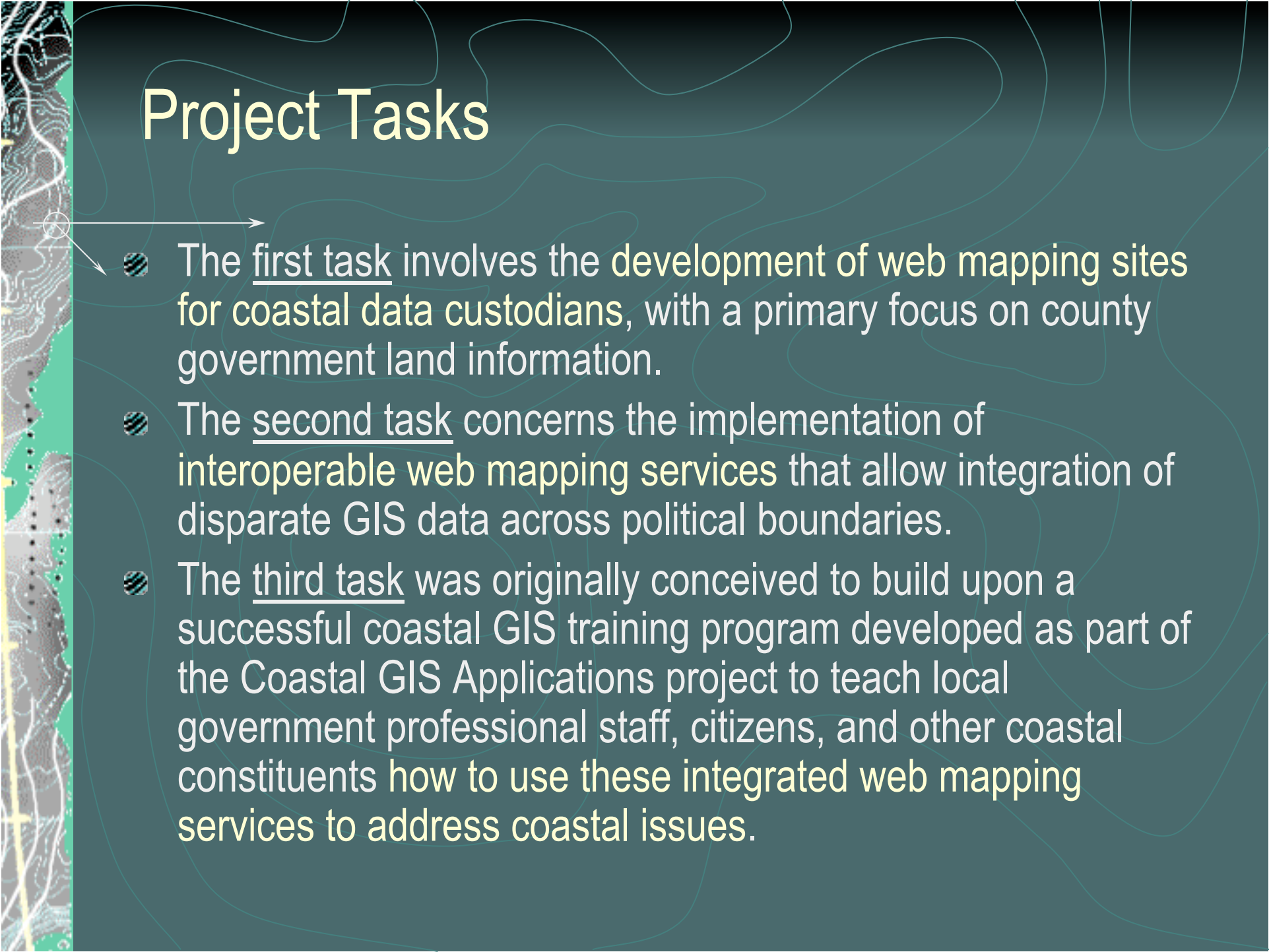
# Lake Superior Coastal Mapping Portal

- The University of Wisconsin Sea Grant Institute and Land Information and Computer Graphics Facility worked to develop a “dynamic and distributed GIS” to support integrated coastal management along the Lake Superior coast of Wisconsin.
- The two-year project (June 2003 to June 2005) was funded by the NOAA Coastal Services Center.



Source: *Visualizing the Great Lakes, EPA*

# Project Tasks

- 
- The first task involves the development of web mapping sites for coastal data custodians, with a primary focus on county government land information.
  - The second task concerns the implementation of interoperable web mapping services that allow integration of disparate GIS data across political boundaries.
  - The third task was originally conceived to build upon a successful coastal GIS training program developed as part of the Coastal GIS Applications project to teach local government professional staff, citizens, and other coastal constituents how to use these integrated web mapping services to address coastal issues.

# Lake Superior Coastal Mapping Portal

**Wisconsin's Lake Superior Coastal Mapping Portal**

WLSCMP **Viewer** Web Mapping Resources Forum

Choose a Map Context

**TOOLS**

- WMS Layers
- Open Context
- Save Context
- OpenSLD
- Save SLD
- Map Size
- Print

**LEGEND**

- US States
- US Counties
- Canadian Provinces
- Great Lakes

Ground Scale: 6965608

Choose a Quick Zoom Location

0 64 128 192 256 320 mi

Geographic Coordinate System: WGS84; EPSG Code 4326

Left: -94.66 Map Units: Degree

Right: -83.60 Dist:

Bottom: 41.49 Mouse X:

Redraw Map

# Lake Superior Coastal Mapping Portal

**Wisconsin's Lake Superior Coastal Mapping Portal**

WLSCMP **Viewer** Web Mapping Resources Forum

**TOOLS**

- WMS Layers
- Open Context
- Save Context
- OpenSLD
- Save SLD
- Map Size
- Print

Choose a Map Context

- Choose a Map Context
- Great Lakes: Weather
- Great Lakes: Sea Surface Temperature
- Great Lakes: Fire Detection
- Great Lakes: Misc. Layers
- Great Lakes: Base Map
- Lake Superior: Sea Surface Temperature
- Lake Superior: Recreation
- Lake Superior: Base Map
- Wisconsin: Parcels
- Wisconsin: Land Use-Land Cover
- Wisconsin: Imagery
- Wisconsin: Base Map
- WI Lake Superior Coast: Parcels
- WI Lake Superior Coast: Orthophotography
- WI Lake Superior Coast: Circle Tour
- WI Lake Superior Coast: Misc. Layers

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0 64 128 192 256 320 mi

Geographic Coordinate System: WGS84; EPSG Code 4326

Left: -94.66 Map Units: Degree  
Right: -83.60 Dist:  
Bottom: 41.49 Mouse X: -87.71

# Lake Superior Coastal Mapping Portal

**Wisconsin's Lake Superior Coastal Mapping Portal**

WLSCMP **Viewer** Web Mapping Resources Forum

Choose a Map Context

**TOOLS**

- WMS Layers
- Open Context
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- OpenSLD
- Save SLD
- Map Size
- Print

**LEGEND**

- lightning
- GOES I/M Winds
- Current Tornado Warning
- Current Thunderstorm Warr
- Current Flash Flood Warni
- Current Special Marine W.
- Current Severe Weather W
- US RADAR
- Weather Warnings
- Texas Mesonet Radar Leger  
courtesy Texas A and M Uni  
(<http://mesonet.tamu.edu/>)
- US States
- US Counties
- Canadian Provinces

Ground Scale: 12081821

Choose a Quick Zoom Location

0 110 220 330 440 550 mi

Geographic Coordinate System: WGS84; EPSG Code 4326

Left: -93.68 Map Units: Degree  
Right: -74.50 Dist:  
Bottom: 38.37 Mouse X:

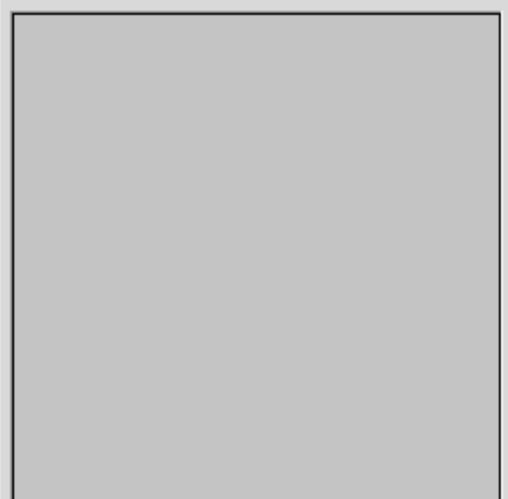


### Explore WMS Layers

**BROWSE:** Select a server in the list below to browse its WMS layers.  
**SEARCH:** Supply search terms in the field below and click the search button.  
Select 'Search Results' from the list at any time to browse the found WMS layers.  
**ADD TO MAP:** Click the 'add to map' button at the bottom of this dialog to add the selected layer.

- Bayfield County: WMS Test \*\*
- Bayfield County: WMS Test \*\*
- Bay Lake RPC: Sheboygan Land Use
- Iron County: WMS
- UW LIGF: Sheboygan Land Use Tes
- SCO: DNR Services
- SCO: DOA Services
- SCO: DOT Services
- UW ERSC: Latest GOES (28May06 21
- UW ERSC: Weather Warnings (29Ma
- UW ERSC: Current Fires
- UW ERSC: Wisconsin Lake Clarity
- UW Sea Grant: LS Circle Tour WMS
- US Census Bureau: TIGER Test \*\*\*
- FEMA: Flood Hazards
- Iowa Mesonet: RADAR
- NASA JPL: POET Test \*\*\*
- NASA JPL: WMS
- Microsoft TerraServer: WMS
- NOAA: ENC Test \*\*\*
- NOAA: NOSA
- SEACOOS: In Situ
- SEACOOS: Remote Sensing
- SEACOOS: WMS
- USFS: Fire Maps Test \*\*
- USFWS: Wetlands Test \*
- USGS EROS: Reference
- USGS: National Map Test \*\*\*
- USGS: NHD-Hydro Test \*\*\*
- USGS: NLCD-Land Cover
- USGS: Weather Warnings

Servers  
Search



**Abstract:** Select a layer.

+ Add Layer    X Close

### LEGEND

- Parcels - Bayfield County, Wisconsin
- Parcels -- Iron County WI
- US States
- US Counties
- Canadian Provinces
- Great Lakes

Redraw Map

0 mi



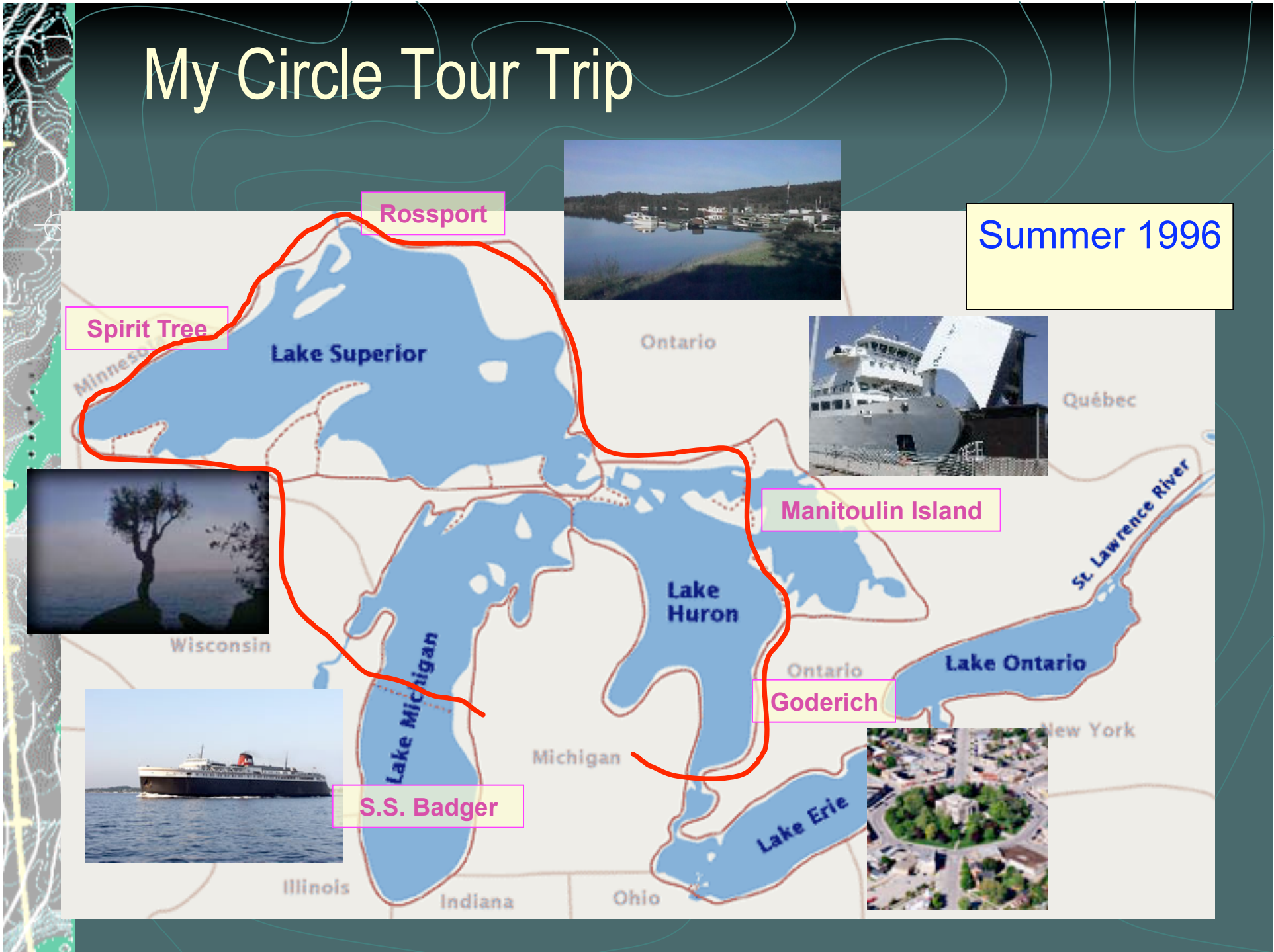
# LSCMP Lessons

- While the LSCMP served as an early testbed showing the potential of integrating web mapping services in Wisconsin, it suffered from slow performance and maintenance issues.
- The Chameleon interface proved to be poorly suited to maintain a functional catalog of interoperable web mapping services.

Lake Superior Coastal Mapping Portal

<http://maps.aqua.wisc.edu/lscmp/>

# My Circle Tour Trip



Rossport

Summer 1996

Spirit Tree



Manitoulin Island



Goderich



S.S. Badger



# Great Lakes Circle Tour – Map Features

## Land

- Circle Tour route
- Parks

## Shore

- Beaches
- Lighthouses
- Boat Access

## Water

- Shipwrecks

## Viewing

- Panorama photos
- Oblique photos
- Webcams

The screenshot shows the 'Beach Health' website. The header includes 'Wisconsin Great Lakes Beaches'. A navigation menu on the left lists: Home, About Beach Health, Daily Conditions, Historical Data, FAQ, Survey, and a 'NEWS' section. The main content area has a 'Beach Health Home' section with introductory text. Below this is a map of Wisconsin with a callout box that says 'Click image to see current advisory map'. To the right of the map is a dropdown menu for selecting a beach, currently showing 'Alford Park Beach, Kenosha County', and a 'Show Advisory' button. Further down, there is a 'Beach Health Hotline: 1-800-441-4636 x1460' and a 'NEWS' section.

Use the map as a means to link to existing web content

The screenshot shows the 'Wisconsin's Maritime Trails' website. The header reads 'Wisconsin's Maritime Trails' and 'Welcome to Wisconsin's Maritime Trails'. Below this is the tagline 'Taking you back to the days when schooners and steamers sailed the Great Lakes.' The main content area features a navigation menu with 'Visit', 'Research', 'Participate', and 'Discover'. To the right of the menu is a text block: 'Explore Wisconsin's rich marine history, spectacular shipwrecks and hundreds of fascinating maritime venues.' Below the menu are three featured sections: 'Shipwrecks on Video' (Explore Wisconsin's historic shipwrecks without getting wet!), 'Kids and Teachers!' (Read a chapter from the new WHS publication "Working With Water"), and 'Wisconsin's Great Lakes Shipwrecks' (Explore some of Wisconsin's most fascinating shipwrecks!). The footer includes logos for 'hi Wisconsin' and 'Sea Grant' and the text 'A Partnership of the Wisconsin Historical Society'.

# Wisconsin Coastal Guide


Great Lakes Circle Tour > Home - Microsoft Internet Explorer provided by Aquatic Sciences Center

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites

Address <http://www.aqua.wisc.edu/glct/> Links

university of wisconsin sea grant



*Wisconsin's*  
GREAT LAKES CIRCLE TOUR  
COASTAL ACCESS GUIDE


Home Maps Links About Contact Us

Maps


- [360° Panoramas](#)
- [Beaches](#)
- [Lighthouses](#)
- [Parks](#)
- [Shipwrecks](#)
- [Webcams](#)

**Get Down to the Water!**

The Great Lakes Circle Tour leads you around the largest freshwater system on the planet – it takes you far from the water's edge. This site shows you where to pull off the highway for a [lighthouse](#), or a secluded [park](#).

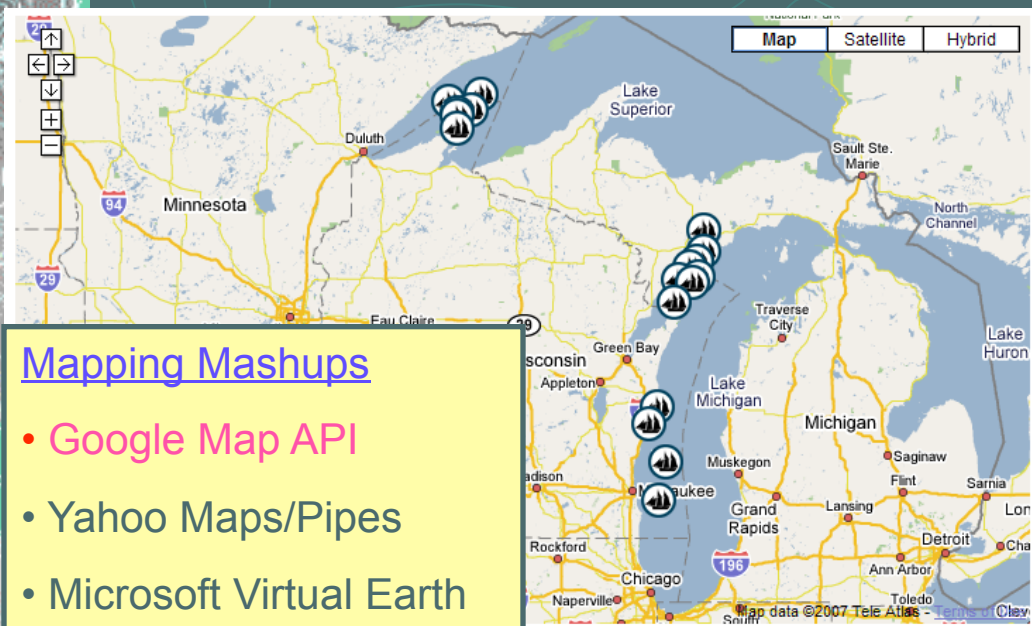
 **360° Panoramas**

Have a look around. More than two hundred 360° photo panoramas show you what things look like in places where you can drive or walk down to the water. The links below the views from beach ramps – even lonely fire lanes where there's nothing to do but admire the view. Accompanying each view is a compass rose showing the direction you are looking as you "turn around."



- [Panorama Photos](#)
- [Lighthouses](#)
- [Shipwrecks](#)
- [Parks](#)
- [Beaches](#)
- [Webcams](#)
- [Oblique Photos](#)

# Wisconsin Coastal Guide – Map Interfaces

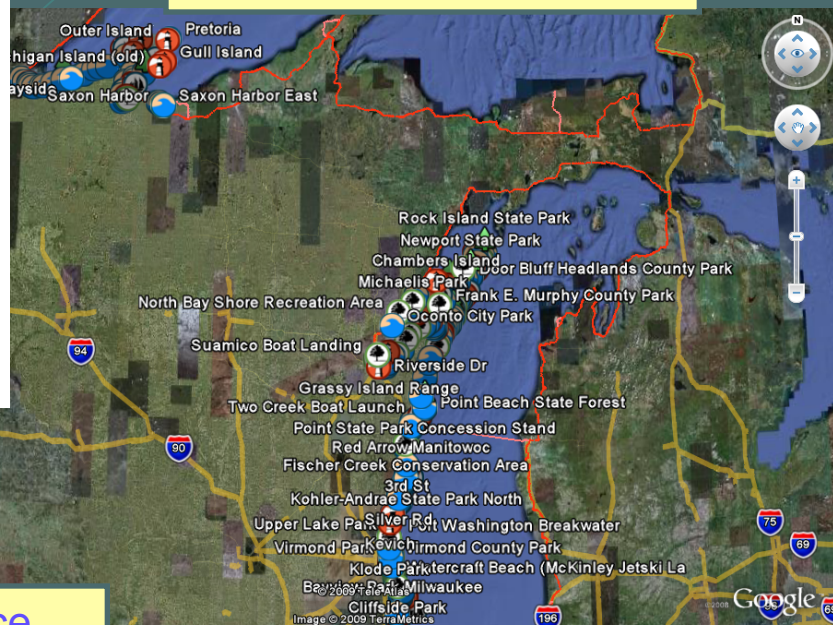


## Mapping Mashups

- Google Map API
- Yahoo Maps/Pipes
- Microsoft Virtual Earth

## Virtual Globe

- Google Earth
- NASA World Wind



## Web Mapping Interface

- OpenLayers
- MapServer/Chameleon
- GeoServer
- ESRI ArcIMS

What are the benefits and drawbacks of different approaches to web mapping?






## WCG Lessons


- KML is now an OGC standard that promotes interoperability. Providing a stable URL to the KML files promotes their use in other web mapping applications (i.e. GLOS HarborView)
- This initial foray into the world of mapping mashups has been beneficial in promoting coastal heritage tourism, but showed how little guidance exists on deciding among the various approaches to developing web mapping interfaces.

Wisconsin Coastal Guide

<http://www.wisconsincoastalguide.org/>

What?

Where? 



[Open Map Viewer](#) ▶

- Any -

[Reset](#) [Advanced](#)

## Welcome to the Sea Grant/SSEC Coastal Map Atlas

We hope this online atlas will help you:

- improve access to and integrated use of spatial data and information
- support decision making
- promote multidisciplinary approaches to sustainable development
- enhance understanding of the benefits of geographic information

Our Coastal Atlas allows easy sharing of geographic data between different organizations.

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 USA  
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 Email: [dhart@aqu.wisc.edu](mailto:dhart@aqu.wisc.edu)

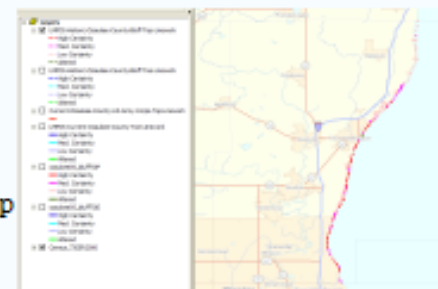
## Categories

- Applications
- Audio/Video
- Case studies, best practices
- Conference proceedings
- Datasets
- Directories
- Interactive resources
- Maps & graphics
- Other information resources

### Featured map

▶ **LAKE MICHIGAN BLUFF TOP - OZAUKEE COUNTY, WISCONSIN - 1956**

This is a shapefile containing polylines that delineate the bluff top for Ozaukee County as it existed in 1956.





What?

Where?



[Open Map Viewer](#)

- Any -

[Search](#)

[Reset](#) [Advanced](#) [Options](#)

Aggregate Results matching search criteria : 1-3/3 (page 1/1), Sort by [Relevance](#)

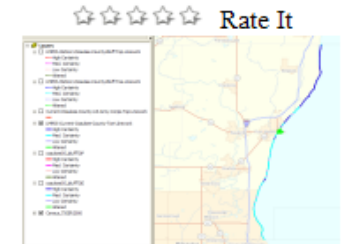
*Logo*

## Lake Michigan Bluff Toe - Ozaukee County, Wisconsin - 1999

**Abstract** This is a shape file containing polylines that delineate the bluff toe for Ozaukee County as it existed in 1999.

**Keywords** Landform, Bluff Toe, Environmental/Hazard, Land Status, Coastal Erosion, Wisconsin, Lake Michigan, Village of Bayside, Town of Port Washington, Ozaukee County, City of Mequon, Town of Grafton, Town of Belgium, City of Port Washington, 1999, Downloadable Data

[Metadata](#)



☆☆☆☆☆ Rate It

*Logo*

## Lake Michigan Bluff Toe - Ozaukee County, Wisconsin - 1956

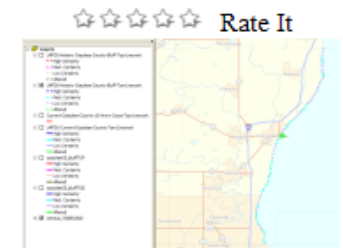
**Abstract** This is a shape file containing polylines that delineate the bluff toe for Ozaukee County as it existed in 1956.

**Keywords** Landform, Bluff Toe, Environmental/Hazard, Land Status, Coastal Erosion, Wisconsin, Lake Michigan, Village of Bayside, Town of Port Washington, Ozaukee County, City of Mequon, Town of Grafton, Town of Belgium, City of Port Washington, United States of America, 1956, Downloadable Data

[Metadata](#)

[Download](#)

[Interactive Map](#)



☆☆☆☆☆ Rate It

*Logo*

## Lake Michigan Bluff Toe - Ozaukee County, Wisconsin - 2005

**Abstract** This is a shapefile containing polylines that delineate the Lake Michigan bluff toe for Ozaukee County as it existed in 2005.

**Keywords** Hazards, Environment, City of Port Washington, City of Mequon, Ozaukee County, Town of Port Washington, Lake Michigan, Village of Bayside, Town of Grafton, Wisconsin, Town of Belgium, Riparian, Land Surface, Aquatic, Biosphere, Spring, 2005, Downloadable Data

[Metadata](#)



☆☆☆☆☆ Rate It

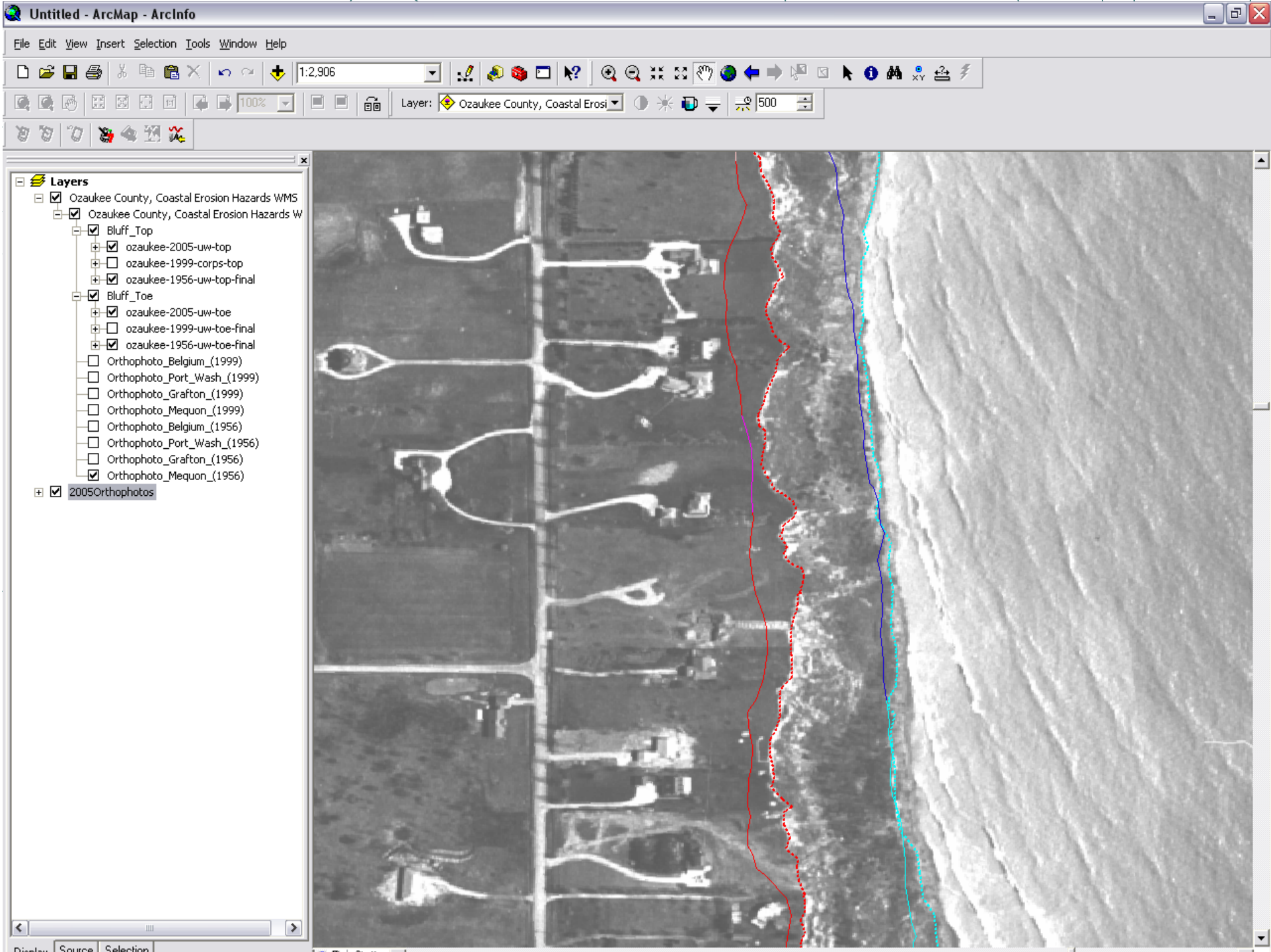
## Categories

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- Case studies, best practices
- Conference proceedings
- Datasets
- Directories
- Interactive resources
- Maps & graphics
- Other information resources
- Photo

## Recent Changes



- Lake Michigan Bluff Toe - Ozaukee County, Wisconsin - 1956



# WCDC Lessons

- Several problems were experienced during the process of installing and utilizing GeoNetwork
  - customizing interface
  - metadata import
  - displaying WMS, KML through the GeoNetwork interface
  - harvesting CSW
- Despite many drawbacks, GeoNetwork still provides the best open source option for implementing a coastal spatial data catalog.

Wisconsin Coastal Data Catalog

<http://speedy.ersc.wisc.edu:8080/geonetwork/>



# Wisconsin Coastal Atlas

- Goal 1: The WCA will serve as the portal to geospatial data for the Great Lakes coasts of Wisconsin
- Goal 2: The WCA will promote the development of a spatial data infrastructure for the Great Lakes coasts of Wisconsin through methods for cataloging, archiving, and semantic integration
- Initial focus on implementing the maps and search components for coastal hazards
- Synchronized with a two-year NOAA Coastal Management Fellow who will help build a Great Lakes spatial decision support toolbox

# Wisconsin Coastal Atlas – Portal Objectives

- 
- Objective 1 – Design and evaluate the WCA using a formalized development process
    - WCA Advisory Committee
    - LOGIC Model for Wisconsin Coastal Atlas

The LOGIC Model could serve as a template to aid design and evaluation of other CWAs.



# Wisconsin Coastal Atlas – Portal Objectives

## ● Objective 2 – Develop the web portal interface for the WCA

- The WCA will be based on the successful Oregon Coastal Atlas
- The OCA serves as a catalyst for data sharing and development of decision support tools for the coastal management community
- The map interface has become a common framework for discussing coastal management issues
- Extension of the four main components (maps, search, tools, learn)
- Collaborate with Oregon State University and the Oregon Coastal Management Program (learn from their experience, share code...)



# Wisconsin Coastal Atlas – Portal Objectives

- Objective 3 – Design, develop, and evaluate web mapping interfaces for the WCA
  - Explore and evaluate the range of web mapping technologies, including geospatial mapping APIs, virtual globes, and internet map servers. Prepare a guidebook for the developers of web mapping portals on the appropriate choice of web mapping technologies for a variety of purposes.
  - Work with the Wisconsin State Cartographer's Office and the Cartography Lab at UW-Madison to ensure that the mapping interfaces employ strong cartographic design principles. Prepare a guidebook for ensuring strong cartographic design in CWAs.

The guidebooks will be useful for CWA developers and the GIS community.



# Wisconsin Coastal Atlas – SDI Objectives

- Objective 4 – Develop and implement a CWA geospatial data catalog with concurrent archiving capabilities.
  - data catalog developed specifically for Great Lakes coastal issues (start with coastal hazards)
  - document technical and institutional barriers to the development of a spatial data catalog of current and historic coastal data
  - robust data archiving procedure to manage data sets over time
  - work with coastal hazards stakeholders to promote the use of catalog open access and data archiving procedures

Advance the development of domain spatial data infrastructures.

Development of effective methods for archive of digital geospatial data will help resolve a critical problem facing data custodians.






# Wisconsin Coastal Atlas – SDI Objectives

## ● Objective 5 – Develop ontologies for coastal hazards in Wisconsin to promote semantic integration

- Develop and conduct two spatial queries to test semantic interoperability for the entire the Great Lakes coasts of Wisconsin using data from local partners as it resides in the geospatial catalog
  - calculate the assessed value of land and improvements of coastal parcels
  - calculate current land use by general zoning categories within the 1000 foot shoreland zoning jurisdiction for the Great Lakes
- Add the WCA as a node in the ICAN interoperability prototype by mapping theme keywords to the global ontology

# WCA Impacts – SDI/Ontology Research

- 
- Application of ontology tools to promote semantic mediation of local government spatial data sets will enable “just-in-time” spatial analyses of coastal issues at a regional scale
  - Participation in the ICAN interoperability prototype will demonstrate how the WCA relates to other CWAs and will be a first step in linking state and provincial atlases to form a Great Lakes Coastal Atlas

# Moving Towards SimGreatLakes

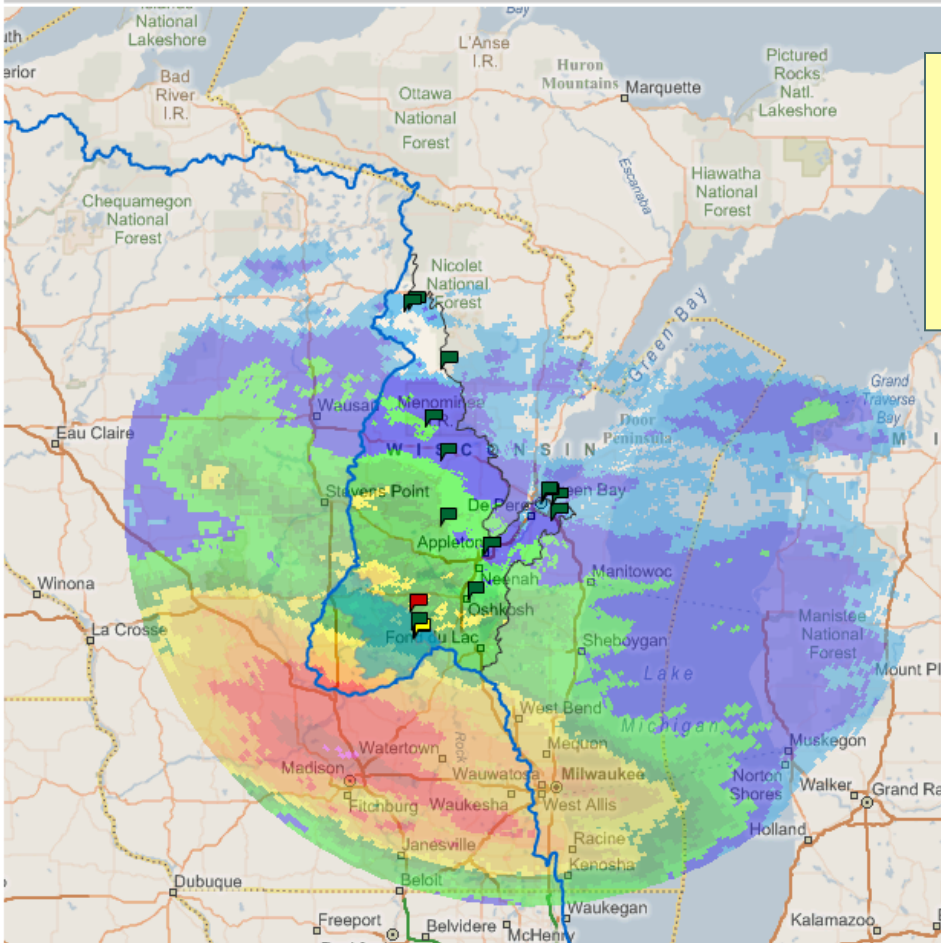
hydrologic dashboard 2.0

[about](#) | [help](#) | [uw sea grant](#)

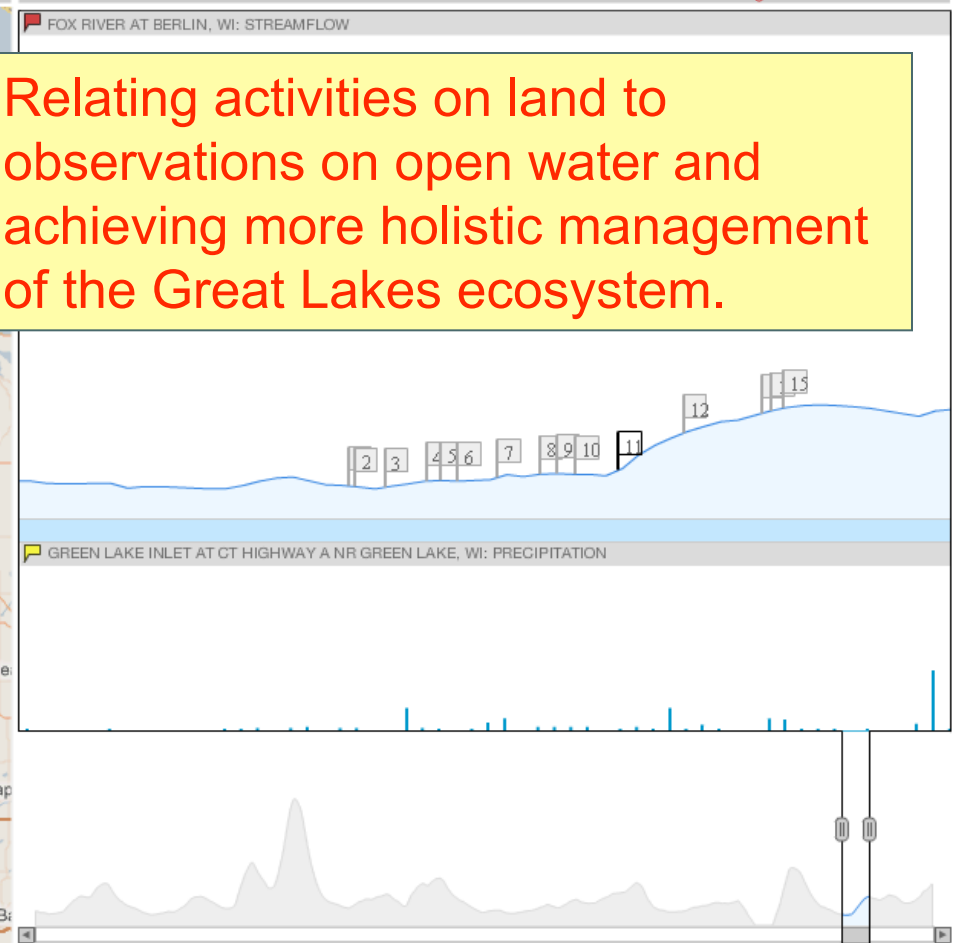
► Stations

ZOOM + -

Sat Aug 18 2007: Storm Event



Relating activities on land to observations on open water and achieving more holistic management of the Great Lakes ecosystem.



MAP OPTIONS

Map layers:

- Fox/Wolf Watershed
- Station Catchment Areas
- Land Cover

Storm event:

Begin: Aug 18 18:25 2007  
End: Aug 21 21:57 2007  
Max storm total precip: 10.3 in  
[View NEXRAD animation](#)  
(opens new browser window)  
 Storm total precip layer

SUMMARY STATISTICS

For the period displayed above (for Main Graph):

Daily Average: 597  
Daily Max: 1270  
Daily Min: 329

Download streamflow data: [GC](#)

# Questions?

**David Hart**

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*Sea Grant Institute*

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*<http://coastal.lic.wisc.edu/>*

*<http://maps.aqua.wisc.edu/>*

*<http://www.seagrants.wisc.edu/gis/>*

