Minnesota's Lake Superior Coastal Program

A Web 2.0 guide to coastal resources, hazards, and habitats

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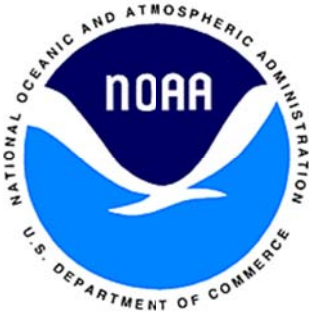

Introduction

Lake Superior's North Shore, due to initiatives by Minnesota's Lake Superior Coastal Program (MLSCP), NOAA, and other federal, state and local efforts, is rich in data. The MLSCP-funded *CoastalGIS* web site, initiated in 2005, provides a means for users to view or download a broad range of spatial data, including spatial data for GIS users, collections of oblique aerial photographs of the Lake Superior shoreline, numerous parcel layers for townships and municipalities, as well as wetland, forest and trail inventories. MLSCP has also supported studies with strong geospatial aspects, such as assessments of impervious surface, trout streams and urban forests. Other data is 'real-time' or time-relevant. The award-winning *www.LakeSuperiorStreams.org* website, funded by MLSCP, US EPA and others, has maintained a network of real-time stream sensors in several urban trout streams, and now has a high-resolution record of core water quality variables dating back to 2002. Other data repositories include Minnesota DNR's Data Deli, which includes information on infrastructure (roads, railroads), land cover (aerial photo, interpreted satellite imagery) and hydrography (rivers, streams, lakes). At the same time, many communities have undertaken studies to quantify and capitalize on the unique social and economic characteristics of this natural resource and tourism-based environment.

However, a persistent issue facing key end users of data, including citizens, local governments, and non-governmental organizations, has been the fact that data are distributed across numerous repositories, often available only in technical formats, which makes them less accessible to end users without GIS expertise. The *Coastal Atlas* project, funded through MLSCP, was designed to consolidate these multiple data sources. The intent of the Atlas was to create print-copy volumes focused on the data needs of individual townships. A set of map plates was created for each township within the coastal boundary, featuring watersheds, hydrography, infrastructure, land use/land cover, recreation and other attributes important to land use planning. These data were also made available on line through the *CoastalGIS* website.

The objective of this current project was to develop a Web 2.0 application to integrate the long-term information provided in the Atlas, *CoastalGIS*, and other sources with real-time or near-real time data related to coastal resources, hazards, and habitats. Web 2.0 refers to Internet applications that go beyond traditional web sites – they facilitate interactive information sharing, drawing information in real time from diverse sites, and connecting with social networks. A unique contribution of this project is the inclusion of real and near-real time data relevant to the health and well-being of citizens in the coastal region. These include beach advisory data, rip current information, weather, recreational opportunities and other attributes of coastal communities.

Work Completed

Outcome 1: A Web 2.0 application that provides integrated content related to Minnesota's coastal region.

Minnesota Lake Superior North Shore Community web app is located at *www.nrri.umn.edu/CoastalGIS/webapp*. Launching the app loads a Google Map session highlighting thirty-two townships and municipalities within the Coastal Program boundary. Information is available at multiple spatial scales. Township-specific maps present information unique to each township, such as population or soil types. There is also information available across the entire coastal program boundary; these layers include weather, beach information, links to oblique aerial photo and other real-time data. Finally, other data layers, such as weather and photos, are available across the entire Arrowhead region.

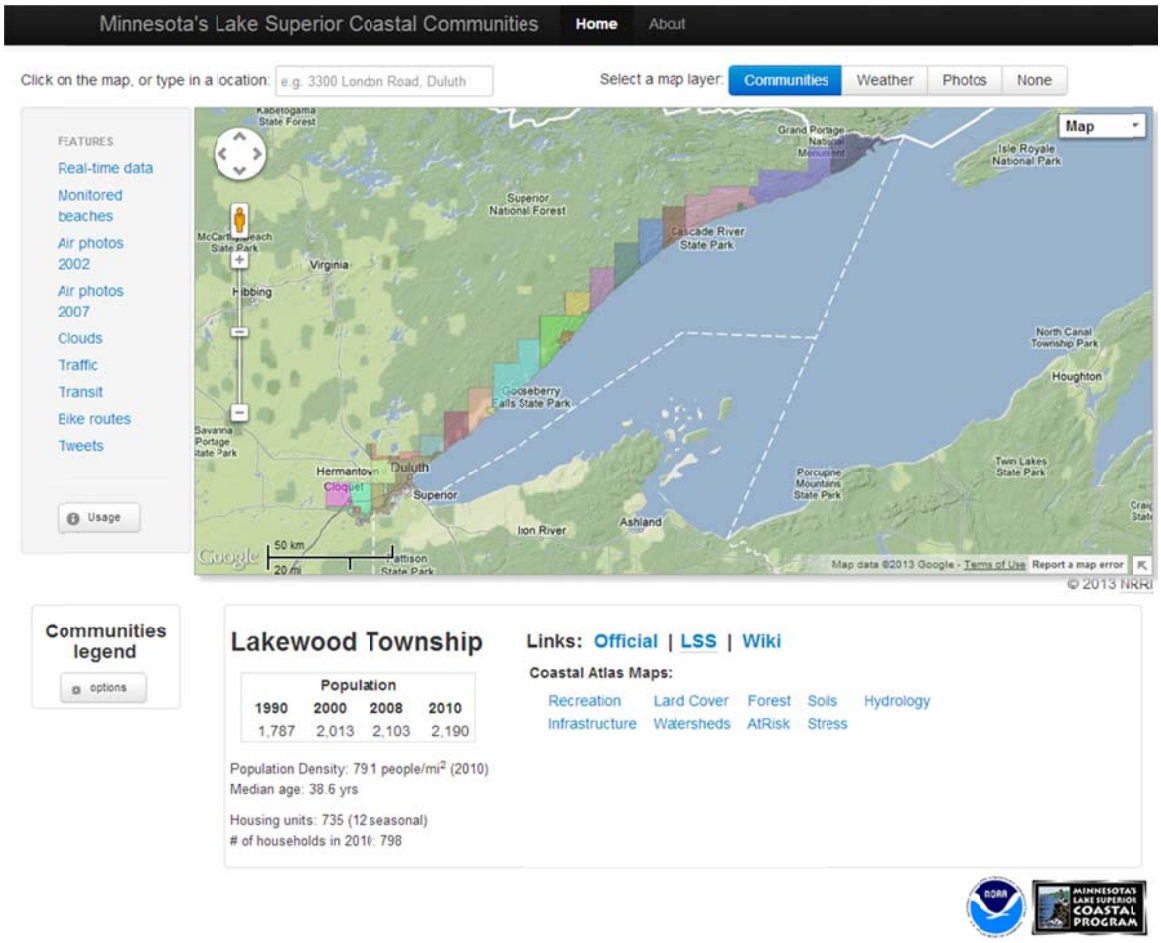

Figure 1. Web app with community layer active.

Township-scale information
Clicking on a township brings up a window with information on its demographics, such as census data housing and age. The map legend can be modified to show, by community, the number of households, population density, median age or the change in population over the last census interval (2000-2010). Transparency of the map colors can be adjusted to allow users to see underlying map layers.

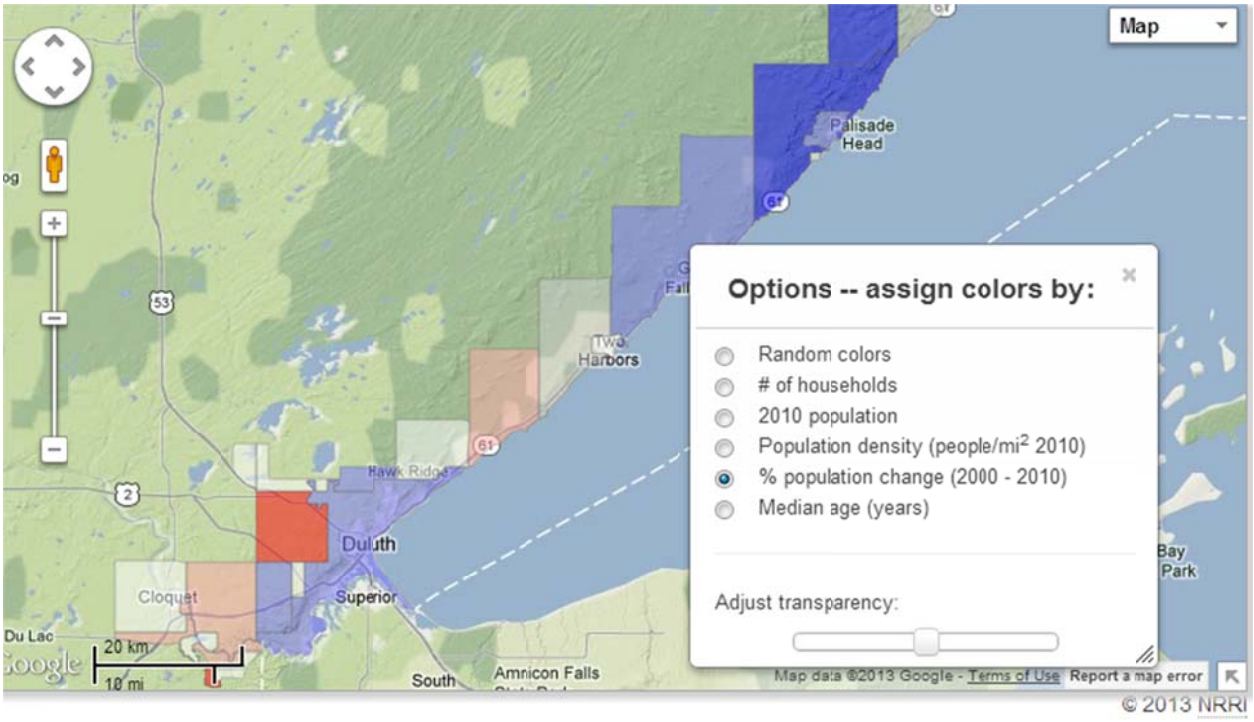

Figure 2. Population change (2000-2010) for coastal communities

The map also provides links to official municipal pages, for example, the Grand Marais community website (*www.grandmarais.com*), as well as Wikipedia entries.

Other maps linked through the Atlas project include:

1. recreation
2. land cover
3. forest cover types
4. water resources: streams, lakes and wetlands
5. infrastructure: roads, rails and waterways
6. soil types
7. watersheds
8. at-risk waters
9. environmental stress / imperviousness

These maps are presented as scaleable PDFs, allowing more information to be presented as the user zooms in. We have included several relatively new data sets, such as a high-resolution watershed delineation (mean size 320 ac; recently funded through the EPA's Great Lakes National Program Office), and a watershed-based index of environmental

stress and erosion hazard. The erosion index includes factors such as stream/road crossings, sedimend erosion risk, and percent impervious land cover.

The following townships and muncipalities are included in the web app:

City of Beaver Bay
Beaver Bay TownshipCanosia Township
City of Carlton
City of Cloquet
Crystal Bay Township
City of Duluth – East, Central and West
Duluth Township
East Cook Unorganized
Grand Lake Township
City of Grand Marais
Grand Portage Unorganized
Hermantown Township
Lake No. 1 Unorganized
Lake No. 2 Unorganized
Lakewood Township
Lutsen Township
Midway Township
City of Proctor
Rice Lake Township
City of Scanlon
Schroeder Township
City of Silver Bay
Silver Brook Township
Silver Creek Township
City of Thomson
Thomson Township
Tofte Township
Twin Lakes Township
City of Two Harbors
West Cook Unorganized
City of Wrenshall

Outcome 2: A "Help Manual" for the Web 2.0 application that describes the structure, design and use of the application.

We created an online "Help Manual" that describes the various capabilities of the site, accessible through the ABOUT link in the upper navigation bar (Appendix A).

Results

The results of this work are the web app and its documentation. The web app integrates baseline information such as roads, land cover, and demographics with real-time data on beach conditions and weather, along with links to community websites.

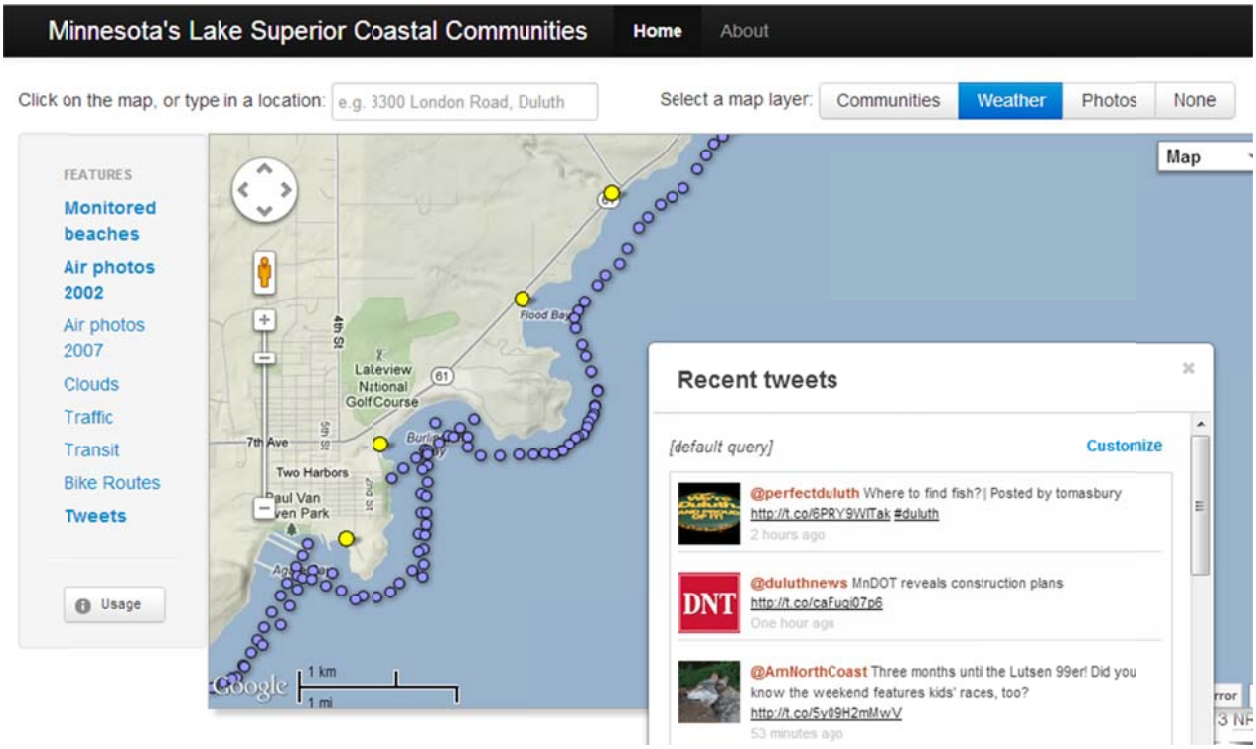

Figure 3. Web app showing beach monitoring sites, oblique photo locations, and Twitter feed.

Key audiences for this work are the residents and visitors to communities of the north shore. This work is relevant because people, and particularly the young people that will form the communities of tomorrow, have become particularly immersed in the information culture and real-time electronic communication. They are Internet-savvy, and are adept at searching multimedia sources to find the information they need. We have designed this site as intuitive, easy to use, and rich in both baseline and contemporary information. In addition to fundamental information, we have added novel map layers that may provide new insights about the north shore - for example, the relative levels of human and physical stress to coastal ecosystems, or the locations of impaired streams. Ideally this will raise public awareness on environmental concerns unique to coastal ecosystems.

Partnerships
This project benefited from data and interpretive assistance from the following agencies:

- Minnesota Department of Natural Resources
- National Weather Service
- Minnesota Sea Grant
- Minnesota Department of Health
- Northland GIS User's Group/North Shore Data Consortium
- City of Duluth

Leveraged Dollars
This web app is an integration of data and information from projects funded by the Coastal Program, the US EPA, and other agencies. It benefited in particular from maps developed through the MLSCP-funded *Coastal Atlas* project; we estimate $10,000-$12,000 in map development time that prepared the maps for inclusion in this web app. The Minnesota Department of Health contributed $11,000 in 2012 toward uploading weekly beach monitoring data and will contribute a similar amount to maintain the program in 2013. Also in 2012 the Great Lakes Restoration Initiative funded development of *ParkPointBeach.org* (estimated $4,000 in leveraged dollars), which provides rip current warnings along with temperature, UV index, and wind and wave information for Duluth beaches; this project continues into 2014.

Conclusions
We were surprised at the many efforts to bring data for decisions to local communities - from the DNR and USGS data repositories, to work by the ARDC, the Department of Health, the city of Duluth, and numerous others. We believe that this project contributes to making that data more accessible in a friendly and intuitive format.

A significant challenge faced by all these agencies, however, is the continued support of monitoring programs that provide beach health, rip current, and stream flow data. These are 'fixed cost' efforts, but are often among the first to face funding cuts in times of budget shortfalls. Efforts like this one increase citizen awareness of the importance of data in their decisions - from land use planning to 'where to swim' on a particular day. Hopefully it will also make them engaged in working with their community decision makers to projects that lead to healthy coastal communities.

Performance Measures Checklist

			If Yes, Please fill in below	
Coastal Hazards	**YES**	**NO**	**Community**	
1. Project conducted activities to reduce future damage from coastal hazards.	☐	☒	If yes, provide the information in the next line	
Please list the name of the community (or communities) and associated county.				
2. Project implemented campaigns to increase public awareness of coastal hazards.	☒	☐	If yes, provide the information in the next line	
Please list the name of the community (or communities) and associated county. Created, released and promoted web app, relevant to all townships and municipalities within coastal program boundary				
	YES	**NO**	**Number of Activities**	**Number of Participants**
4. Project conducted educational activities	☐	☒		
5. Project conducted training activities	☐	☒		
6. Project conducted coordination activities	☐	☒		

Future Plans

New features may be added to this website as information becomes available from our partner agencies. We will continue to maintain this web app and the *CoastalGIS* website as long as practicable; *CoastalGIS* has now been up and running for eight years. We continue to seek funding for maintenance and expansion of important geospatial data for coastal communities of Lake Superior's north shore.

Appendix A - User's Guide

Minnesota's Lake Superior Coastal Communities:

A Web 2.0 guide to coastal resources, hazards and habitats

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Introduction

This website is a window to a large number of information sources and data sets relevant to the coastal communities of Minnesota's Lake Superior North Shore. These include real-time information on weather, traffic, and beach conditions, as well as map information on recreational opportunities, population, and land cover.

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Usage

Navigation
The basic in standard web map format, with controls for zooming in and out and panning. The map is designed so that layers become visible at appropriate zoom levels (major roads when zoomed out, smaller roads when zoomed in). In addition to standard navigation tools, a user can type in an address in the text box in the upper left, and the map will reorient itself centered on that address.

Map Layers
The top row of the site allows the selection of the active map layer. By default, the **COMMUNITY** layer is active. Clicking on a community on the map brings up a window with information on its demographics, such as census data housing and age. The **Communities Legend** options allow different demographics to be mapped. The legend can be modified to show, by community, the number of households, population density, median age, or the change in population over the last census interval (2000-2010). (Population over time, age, housing). Transparency of the map colors can be adjusted to allow users to see underlying map layers.

Other Map Layer options include **Weather** and user-submitted **Photos**. Only one map layer can be active at a time.

Features
The **Features** column on the left side of the map window presents additional data layers available across the site, multiple layers can be turned on at one time.

- *Monitored Beaches* - these are beaches monitored by the Coastal Swimming Beach Monitoring Program, funded by the U.S.
- Environmental Protection Agency. Beaches are monitored for bacterial indicators of water-borne fecal contamination that can make swimmers and water recreators sick. The points on the map link to the appropriate page on *www.MNBeaches.org,* which provide further information on that particular beach, including status of advisory, along with temperature, sky conditions, and other local information.
- *Air Photos* - these are links to oblique air photos of Lake Superior's coast collected in 2002 and 2007
- *Clouds, Traffic and Transit* are real-time data feeds provided by Google

- *Tweets* - this is a listing of the most recent Twitter feeds from a number of sources relevant to the North Shore, including Minnesota Sea Grant, the major regional and local news stations, and selected local observers.
    - The app downloads and displays the 10 latest tweets matching the search criteria
    - Every 45 seconds, up to 10 newer tweets are downloaded
    - Every 5 seconds, one is added to the screen
    - The last 30 tweets are shown, earlier ones are deleted
    - Users can enter custom queries to search for specific topics

Links
The **Links** section on the lower right of the screen becomes active when the user clicks on an individual community. These connect to official municipal web pages, for example, the Grand Marais community website (*www.grandmarais.com*), when available.They also connect to Wikipedia entries and other relevant links, including community pages on *www. LakeSuperiorStreams.org.*

The **Links** also connect to a series of maps created for the *Coastal Atlas* project. Available map layers include:

recreation
land cover
forest cover types
water resources: streams, lakes and wetlands
infrastructure: roads, rails and waterways
soil types
watersheds
at-risk waters
environmental stress / imperviousness

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New features may be added to this website as information becomes available.