Chapter 10
Data Management System

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Introduction

Purpose of the Data Management System within the Great Lakes Coastal Wetlands Consortium

The Great Lakes Coastal Wetlands Consortium has worked for several years to evaluate select State of the Lakes Ecosystem Conference (SOLEC) indicators as tools for the long-term monitoring of coastal wetland health throughout the Great Lakes. The final result is a set of protocols for gathering and assessing data related to aspects of coastal wetlands ecosystems. Because of the variety of topics being considered, the geographic extent of the region and the number of organizations involved, the Consortium recognized the need for a data-sharing mechanism for use by its members.

The Consortium was seeking a standardized approach that could be applied across the region, allowing data gathered by any of its members to be easily shared, compared and integrated into analytical processes. A centralized, online data management system (DMS) was chosen as the approach to handle this need. The DMS was conceived as an Internet-based application housed on the Consortium's website and open to the research community. Data gathered in the field and from laboratory processes would be recorded in standardized formats and uploaded to a data archive. These data files would be indexed by site, date and protocol. They could then be retrieved using the same parameters.

Status of the System

The first iteration of the Consortium's DMS consists of 1) an online database for indexing and archiving data files, 2) an online user interface that includes tools for submitting data files to the archive and for locating and retrieving files that are already stored there, and 3) a data template that will allow field measurement results to be prepared and submitted in a uniform format. The data template was considered an important component for the current system because it allows researchers and field personnel to record data in a variety of settings, while ensuring that data will be readily useable by others. The template has been designed as a stand-alone document and was formatted for use with Microsoft Excel and other compatible spreadsheet software.

Data providers are required to register before they can upload files. Active members of the Consortium's development committees were registered as users when the system was created. New data providers will have to submit a registration request and be approved by Consortium staff before they will be allowed to upload files. Data users will be asked to register as a means of tracking the system's audience, but access to the data files will not otherwise be restricted.

As of this report, the DMS contains only sample data files. Registered users can download and view them as part of orienting themselves to the system and to the data template. The system is ready to accept files containing actual data at any time.

Summary of Resources

The DMS consists of 1) a PHP/mySQL database connected to a data file archive on the Great Lakes Coastal Wetlands Consortium web site (http://www.glc.org/wetlands/cwc/), 2) online data file submission and retrieval forms and 3) an Excel-based data file template for use by investigators as they prepare their data for submission (see Appendix I). The system is essentially self-contained and could be moved to another server with only limited modification.

System Design

Internet Software

The file archiving database behind the DMS was built using PHP and mySQL and is published using an Apache webserver. This is an industry standard, widely supported software configuration that can be readily maintained and updated. It is currently housed on an Apache server managed by the Great Lakes Commission. Users connect to the database via the Internet using a standard web browser. The web interface allows the user to search the repository database and locate files, which can then be downloaded to the user's local computer.

Data Handling Design and Software

The data archived in the DMS are stored as Microsoft Excel files. Once downloaded, the data files can be opened and manipulated using Microsoft Excel or other compatible spreadsheet software on the user's personal computer. A file archive approach was chosen by the DMS design team because it allowed field personnel to record data at their convenience and in a format that would be readily useable during other monitoring, analysis and reporting phases. It also allowed the DMS design team to match the protocol development timeline used by the Consortium's Scientific Committee.

Data File Template

A template for storing field data was developed based on protocols for each of the wetland characteristics being measured. The template consists of an Excel spreadsheet containing worksheets for each of 20 wetland assessment methods or indicator characteristics. Field teams will use Consortium protocols to measure indicators for the sites they investigate, record their results, then submit the completed file for any given investigation event to the DMS. The files will be stored with critical metadata to allow the database to be searched by date, site, wetland type and/or protocols used. Template parameters can be found in Appendix I.

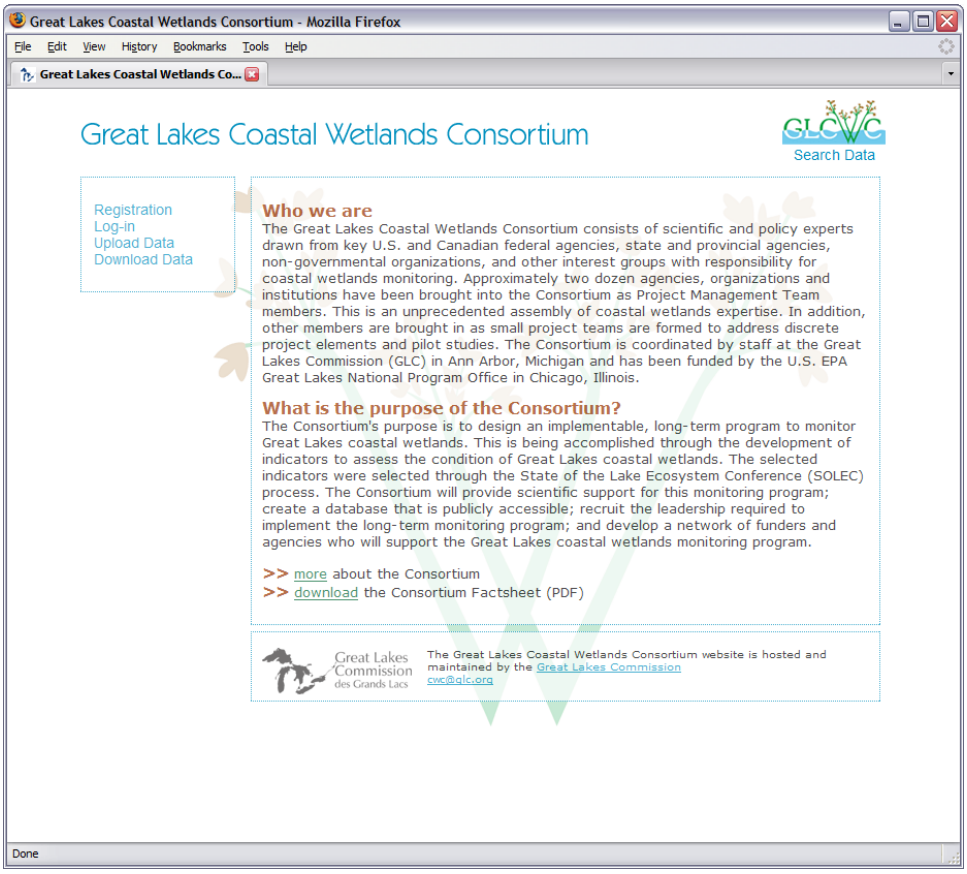
The Microsoft Excel workbook was chosen as the data input software for the first iteration of the DMS because it is a standard application. The software is available for Microsoft Windows-based laptops and Macintosh computers, and the file format can be used in Linux-based software. Data can be entered at the investigator's convenience, then uploaded to the DMS using a standard web browser at any time that internet access is available.

Data retrieval takes place through an online search of the DMS which returns Excel files for the selected sites and dates. For multisite comparisons or temporal analyses, the investigator is required to process the individual files to meet his or her needs.

System Inputs and Outputs

DMS Website

The DMS is accessed through the Great Lakes Coastal Wetlands Consortium website at http://www.glc.org/wetlands/cwc/index.html. Users are offered background information about the Consortium and the DMS, and links to the system's various components.



Data Uploads

Data files are uploaded to the DMS through an interactive web page. This form requires investigators to provide basic reference information at the time the file is uploaded. The mandatory file characteristics that must be entered serve as metadata within the DMS, allowing searches based on the date that a given site visit took place; the specific site location, either by name or by geographic coordinates; the type of wetland being investigated and/or the investigations carried out at that site.

Data Downloads

Data files are retrieved through an interactive web page. This form requests characteristics about the site (name or geographic location), protocol and/or date of interest and then returns the archived Excel files that match the search parameters.

Appendix 10-1. Data File Template

Data are stored in the Coastal Wetlands DMS as preformatted Excel workbooks. A template is provided on the Great Lakes Coastal Wetlands Consortium website, http://www.glc.org/wetlands/cwc/index.html. The Excel workbook template contains spreadsheets for each of the procedures specified by the Consortium's protocols so that data for a given site and sampling date can be stored in a single file.

The template structure is diagrammed below:

Template Worksheet Name	Template Worksheet Fields
SITE	Site name
	Site ID
	Sample date
	Wetland classification
	Associated waterbody
	Latitude
	Longitude
	Projection
	Comments
NEW_ELECTRO_SAMPLING	Site name
	Site ID
	Plant community
	Fluvial zone
	Vegetation zone
	Gear
	Voltage
	Amps
	GPP seconds fished
	Total time fished (minutes)
	Length fished (meters)
	Width fished (meters)
	Start time (EDT)
	% fish captured
	Species
	Length (cm)
	Weight (g)
	Condition
	Comments

SWEEP NETTING	Site name
	Site ID
	Plant community
	Date
	Picking method
	Sample ID
	Comments

ACTIVITY TRAPS	Site name
	Site ID
	Plant community
	Trap #
	Set depth
	Set date
	Clear date
	Sample ID
	Comments
HESTER-DENDY	Site name
	Site ID
	Plant community
	Set depth
	Set date
	Clear date
	Sample ID
	Comments
UV LIGHT TRAPS	Site name
	Site ID
	Plant community
	Trap #
	Set date
	Clear date
	Sample ID
	Comments
FYKE NETS	Site name
	Site ID
	Plant community
	Trap #.
	Net size
	Set depth
	Set date
	Clear date
	Species
	Length

	Weight (g)
	DELT
	Comments

MINNOW TRAPS	Site name
	Site ID
	Plant community
	Trap #
	Set depth
	Set date
	Clear date
	Species
	Length
	Weight (g)
	DELT
	Comments
ELECTROFISHING	Site name
	Site ID
	Plant community
	Buoy #
	Start time (EDT)
	Sampling effort (min)
	% fish captured
	Species
	Length
	Weight (g)
	DELT
	Comments
GILL NETS	Site name
	Site ID
	Plant community
	Net set number
	Net size
	Set depth
	Set time
	Clear time
	Species
	Length
	Weight (g)
	DELT
	Comments

NEW_FYKE_SAMPLING	Site name
	Site ID
	Plant community
	Trap #
	Net size
	Set depth
	Set date
	Clear date
	Species
	Length
	Weight (g)
	DELT
	Comments
VEGETATION	Site name
	Site ID
	Plant community
	Quadrat #
	Sample #
	Date
	Water depth (m)
	Sediment
	OM depth
	Sampling point location
	Distance from point (m)
	Degrees from point
	Dimensions
	Sampling time
	Species
	% Species cover
BIRDS	Site name
	Site ID
	Plant community
	Route ID
	Route name
	Date
	Visit
	Station
	Species
	Count
	Outfly
	Indicator species
	Presence
	Birdair

AMPHIBIANS	Site name
	Site ID
	Plant community
	Route ID
	Route name
	Date
	Visit
	Station
	Species
	Count
	In
	Indicator species
LANDSCAPE ALTERATION	Site name
	Site ID
	Project
	Date
	Crew
	Plant zone
	Dewatering in or near wetland
	Point source inlet
	Installed outlet, weir
	Ditch inlet
	Tile inlet
	Unnatural connection to other waters
	Presence of barriers (dams, waterfalls)
	Tree removal
	Tree plantations
	Mowing or grazing
	Shrub removal
	Coarse woody debris removal
	Removal or emergent vegetation
	Presence of livestock hooves
	Presence of vehicle use
	Presence of grading/bulldozing
	Presence of filling
	Presence of dredging
	Sediment input (from inflow or erosional)
	Areas of land in high public use
	Proximity to navigable channels (m)
	Proximity to recreational boating activity (m)
	Proximity to roadways that receive regular traffic (m)
	# of dwellings
	# of industries
	# of other buildings

	# of boat docks
	# of paved parking lots
	# of dirt parking lots
	# of boat launches
	% hardened shoreline
	% eroding shoreline
	% shoreline containing a visible dirt road
	% shoreline containing a visible paved road
	Habitat types adjacent to wetland (est. %, groundtruthing)
	Land-use classes adjacent to wetland (est %, groundtruthing)
	Note construction sites or obvious sedimentation
	Note highway, rail, levees, berms, boardwalks or other such structures built in or around wetland including whether or not the structure appears to restrict hydrological connection
	Categorical degree and type of direct human activity - categories number coded in sequence with increasing activity
	Comments
CONTAMINATED SEDIMENTS	Site
	Vegetation zone
	Plant type
	Sample
	Log number
	Date sampled
	% solids
	% TOC
	Naphthalene (mg/kg)
	Acenaphthylene (mg/kg)
	Acenaphthene (mg/kg)
	Fluorene (mg/kg)
	Phenanthrene (mg/kg)
	Anthracene (mg/kg)
	Fluoranthene (mg/kg)
	Pyrene (mg/kg)
	Benzo(a)anthracene (mg/kg)
	Chrysene (mg/kg)
	Benzo(b)fluoranthene (mg/kg)
	Benzo(k)fluoranthene (mg/kg)
	Benzo(a)pyrene (mg/kg)
	Indeno(1,2,3-cd)pyrene (mg/kg)
	Dibenzo(a,h)anthracene (mg/kg)
	Benzo(g,h,i)perylene (mg/kg)
	Total PAH Compounds (mg/kg)
	DDD (ug/kg*)
	DDE (ug/kg*)

	DDT (ug/kg*)
	Total PCBs (ug/kg*)
	Ammonia (mg/kg)
	Chromium (mg/kg)
	Lead (mg/kg)
	Cadmium (mg/kg)
	Mercury (mg/kg)
WATER QUALITY	Site name
	Site ID
	Plant community
	Date
	Time
	Sample #
	Sample date
	Volume of water
	Water depth (cm)
	Secchi depth (m)
	Turbidity (NTU)
	Water temp. (deg C)
	Air temp. (deg C)
	pH field
	Dissolved oxygen (mg/L)
	Chlorophyll a (mg/L)
	Redox potential (mohms)
	Conductivity field (?S/cm)
	Total dissolved solids (ppm)
	Salinity (PSS)
	Comments
PICTURES	Roll #
	Picture #
	Site name
	Site ID
	Date
	Description
CREW	Date
	Site name
	Site ID
	Crew
	Weather
	Description of day's activities