

Great Lakes Coastal Wetland Decision Support Tool

Geospatial data sources and operations

Version: 1.0

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Abstract:

The Great Lakes Coastal Wetland Decision Support Tool is a web based data viewer and prioritization tool that uses data from a variety of sources. Geospatial data have been used to generate attributes for coastal wetlands within the study area. Geospatial data sources and the processes used to generate attributes from these data are described below.

Land Ownership Fields

An ownership layer was created by combining data from four different sources:

1. Conservation and Recreation Lands (CARL), 2013 By: Ducks Unlimited
<http://www.ducks.org/conservation/glaro/carl-gis-layer>
2. Federal, State, Tribal, etc. Protected Areas Land Ownership (GAP), 2011 By: USGS
<https://gdg.sc.egov.usda.gov/GDGOrder.aspx>
3. National Conservation Easement Database, 2012 By: National Conservation Easement Database
http://www.conservationeasement.us/easements/download_links
4. TIGER American Indian Lands, 2010 By: U.S. Department of Commerce and U.S. Census Bureau
<https://gdg.sc.egov.usda.gov/GDGOrder.aspx>

The following layer was used to remove “unowned” water areas from wetlands and wetland buffers:

5. USGS National Hydrography Dataset (NHD) Best Resolution for Michigan and Ohio, 2016 By: U.S. Geological Survey
<http://viewer.nationalmap.gov/basic/#productSearch>

Process

The CARL layer was the primary file used. In locations where both CARL layer and GAP layer overlapped and shared attributes, CARL data was used. Each layer was cleaned to share a common ownership field and merged based on ownership.

A simple merge could be used to combine all four datasets, but small inconsistencies were noted between the CARL and GAP datasets. In order to create a consistent simplified dataset the following operations were performed:

1. All datasets were reprojected to NAD83 17N.
2. USDA GAP Ownership was collected at the county level so each county was merged together into a comprehensive AOI file.

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3. CARL and GAP data contained some overlap. Since the CARL data is 2 years newer and contains a greater level of detail, CARL information was used in overlapping areas. Column names were adjusted so that similar information shared titles. Datasets were then merged into a comprehensive ownership layer.
4. The same process was applied to combine the merged CARL-GAP layer and the easement layer.
5. Wetland or wetland buffer areas overlapping lakes, rivers, and streams according to the National Hydrography Dataset were removed to get accurate “ownable” land estimates.
6. Water areas removed from wetlands or buffers were calculated and water cover percentages were calculated for each wetland and wetland buffer.

The following land ownership fields are included as attributes in the Decision Support Tool in the “geopolitical” category:

| | |
|--------------------------------|---|
| Federal Area (ha) | Area of polygon (hectares) that is federal land. |
| % Federal | Percentage of polygon that is federal land (excluding surface water). |
| Adjacent federal land | Percentage of upland within 200m buffer around wetland perimeter that is federal land |
| State Area (ha) | Area of polygon (hectares) that is state land. |
| % State | Percentage of polygon that is state land (excluding surface water). |
| Adjacent state land | Percentage of upland within 200m buffer around wetland perimeter that is state land |
| County (ha) | Area of polygon (hectares) that is county land. |
| % County | Percentage of polygon that is county land (excluding surface water). |
| Adjacent county land | Percentage of upland within 200m buffer around wetland perimeter that is county land |
| Municipal (ha) | Area of polygon (hectares) that is local municipality land. |
| % Municipal | Percentage of polygon that is local municipality land (excluding surface water). |
| Adjacent municipal land | Percentage of upland within 200m buffer around wetland perimeter that is local government land |
| NGO Area (ha) | Area of polygon (hectares) that is owned by a non-governmental organization. |
| % NGO | Percentage of polygon that is owned by a non-governmental organization (excluding surface water). |
| Adjacent NGO land | Percentage of upland within 200m buffer around wetland perimeter that is NGO land |
| Private Area (ha) | Area of polygon (hectares) that is assumed to be private land. |
| % Private | Percentage of polygon that is assumed to be private land (excluding surface water). |
| Surface Water Area (ha) | Area of polygon (hectares) that is surface water. |
| Adjacent water | Percentage of 200m buffer around wetland perimeter that is open water |
| Conservation easement | Is there a conservation easement within the wetland polygon |
| Easement ownership | What is the type of easement ownership |
| Easement management | Entity responsible for management of the easement |

Government Unit Fields

Township level information was created using freely available county level PLAT maps (<https://gdg.sc.egov.usda.gov/>).

Process

A township file was created by downloading a separate township file for each county in the AOI and merging them together. This file was then laid over the wetland shapefile and associated township names were recorded for each wetland.

The following government unit fields are included as attributes in the Decision Support Tool in the “geopolitical” category:

| | |
|-----------------|---|
| State | State where wetland is located |
| County | County (or counties) where wetland is located |
| Township | Township (s) where wetland is located |

Accessibility Fields

Wetland accessibility data was collected and created. For the purposes of this product it was important to know whether individuals could easily travel to a wetland and if each wetland was available for general use by the public. Travel accessibility data was collected by using the NAIP imagery, wetland boundaries polygon file, and a roads layer to determine if each wetland was reachable by road.

The following accessibility fields are included as attributes in the Decision Support Tool in the “general” category:

| | |
|---------------------------|---|
| Public Road Access | Wetland is accessible by public road (either adjacent or intersecting wetland). |
| Access Options | Describes access options (Road, Road+Ferry, Overland, Boat). |

Phragmites Density Fields

Phragmites data can be found at:

<https://www.sciencebase.gov/catalog/item/5330a885e4b00b385d76fa38>.

Process

Phragmites polygon area within each wetland polygon and for 5km buffers surrounding each wetland were calculated. Open water areas were excluded based on the EPA/Michigan Tech. land cover raster layer. This raster was used because most other available lake and hydrologic layers classify the majority of coastal wetland regions as open water rather than vegetation. A fine detail raster layer was created

from the *Phragmites* polygon shapefile, with resolution of 1 meter or finer. The tabulate area tool was then used to calculate *Phragmites* area.

The following *Phragmites* density unit fields are included as attributes in the Decision Support Tool in the “biological” category:

| | |
|--|---|
| Phragmites % within wetland | Percentage Phragmites within wetland polygon. |
| Phragmites % within 5-km Buffer | Percentage Phragmites within 5 km buffer. |

Surrounding Upland Population Density Fields

Census data can be downloaded from <https://www.census.gov/geo/maps-data/data/tiger.html>.

Process

The first step was to create a new column in the Census Block shapefile and calculate the area in hectares of each Census Block. Then open water area was removed from each buffer. The US Lakes and Rivers/Streams datasets were downloaded from <http://www.nohrsc.noaa.gov/gisdatasets/> and used to remove water from each buffer. Canadian land was also removed from buffers. The intersect tool was used to create a new layer that contained Census Block polygons that overlap the wetland buffers. A code was created that adds all the estimated population values from the intersected file for each wetland and then sums them together.

The following population density unit fields are included as attributes in the Decision Support Tool in the “population” category:

| | |
|---|--|
| Pop. Density (within 1-km buffer) | Human population density (people per hectare) within 1 km buffer. |
| Pop. Density (within 5-km buffer) | Human population density (people per hectare) within 5 km buffer. |
| Pop. Density (within 10-km buffer) | Human population density (people per hectare) within 10 km buffer. |

Surrounding Upland Housing Density Fields (Present and Future)

These metrics were generated by using the “1940-2030 Housing Density” shapefile that was developed by Roger B. Hammer (Oregon State University), Volker C. Radeloff (University of Wisconsin Madison), and Susan I. Stewart (USDA Forest Service Northern Research Station). The data and the metadata can be viewed at: <http://silvis.forest.wisc.edu/data/1940-2030-housing-density-pbg> . In 2008 the authors used block group and sub-block group level Census housing data from the year 2000 and before to predict housing estimates for the years 2010, 2020, and 2030.

Process

Housing density metrics were calculated using the same method as Upland Population Density Fields. The following housing density unit fields are included as attributes in the Decision Support Tool in the “population” category:

| | |
|---|---|
| Houses per hectare within 5-km buffer | Houses per hectare in 5 km buffers in 2010. |
| Houses per hectare within 10-km buffer | Houses per hectare in 10 km buffers in 2010. |
| Change in Housing Density for 10-km Buffer (2010-30) | Projected change in housing density between 2010 and 2030 for 10 km buffers. |
| % Change in Housing Density for 10-km Buffer (2010-30) | Projected percentage change in housing density between 2010 and 2030 for 10 km buffers. |

Wetland and Watershed NLCD Land Coverage Percentages

Land cover data are available at <http://www.mrlc.gov/nlcd2011.php>.

Process

Metrics in this category were generated by using the 2011 national land cover dataset, updated Great Lakes coastal wetland inventory, watershed, and Canadian Census provinces/territories layers. A wetland buffer model was created in Model Builder that calculates the area of each NLCD class within each wetland buffer (buffers of 1km, 5km, and 10km). The model reads in the updated wetland polygon layer and creates 3 new layers: 1km buffer, 5km buffer, and 10km buffer. It is important to note that each buffer is built around the wetland and does not include the wetland area itself. The NLCD AOI was converted to vector prior to analysis. Land cover percent categories (one unique category for each land cover type at each buffer size) include:

- P_OW is the percent open water coverage
- P_DOS is the percent developed open space coverage
- P_DLI is the percent developed low intensity coverage
- P_DMI is the percent developed medium intensity coverage
- P_DHI is the percent developed high intensity coverage
- P_BL is the percent barren land coverage
- P_DF is the percent deciduous forest coverage
- P_EF is the percent evergreen forest coverage
- P_MF is the percent mixed forest coverage
- P_SS is the percent shrub/scrub coverage
- P_H is the percent herbaceous coverage

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- P_HP is the percent hay/pasture coverage
- P_CC is the percent cultivated crops coverage
- P_WW is the percent woody wetland coverage
- P_EHW is the percent emergent herbaceous wetland coverage
- P_U was the percent unclassified coverage, but it was removed because it was added to the open water category based on the idea mentioned at the top of this section

NLCD classes above were summarized to 5 new classes, including open water, agricultural land, developed land, barren land, and forested land.

The following buffer and watershed land use and cover fields are included as attributes in the Decision Support Tool in the “buffer” category:

| | |
|------------------------------------|--|
| 1-km Buffer - % Open Water | Percentage open water within 1 km buffer (including Great Lakes). |
| 1-km Buffer - % Ag Land | Percentage agricultural land within 1 km buffer. |
| 1-km Buffer - % Developed | Percentage developed land within 1 km buffer. |
| 1-km Buffer - % Barren | Percentage barren land within 1 km buffer. |
| 1-km Buffer - % Forested | Percentage forested land within 1 km buffer. |
| 1-km Buffer - % Wetland | Percentage wetland within 1 km buffer. |
| 5-km Buffer - % Open Water | Percentage open water within 5 km buffer (including Great Lakes). |
| 5-km Buffer - % Ag Land | Percentage agricultural land within 5 km buffer. |
| 5-km Buffer - % Developed | Percentage developed land within 5 km buffer. |
| 5-km Buffer - % Barren | Percentage barren land within 5 km buffer. |
| 5-km Buffer - % Forested | Percentage forested land within 5 km buffer. |
| 5-km Buffer - % Wetland | Percentage wetland within 5 km buffer. |
| 10-km Buffer - % Open Water | Percentage open water within 10 km buffer (including Great Lakes). |
| 10-km Buffer - % Ag Land | Percentage agricultural land within 10 km buffer. |
| 10-km Buffer - % Developed | Percentage developed land within 10 km buffer. |
| 10-km Buffer - % Barren | Percentage barren land within 10 km buffer. |
| 10-km Buffer - % Forested | Percentage forested land within 10 km buffer. |
| 10-km Buffer - % Wetland | Percentage wetland within 10 km buffer. |

Table of Datasets Used

| Dataset Name | File Format | Resolution (m) | Source |
|--|--------------------|-----------------------|---|
| Great Lakes Total Updated Land Cover | TIF | 12.5 | Environmental Protection Agency, Michigan Technological Research Institute, 2011 |
| National Land Cover Dataset by State (NLCD) | TIF | 30 | U.S. Geological Survey, 2011 |
| Federal Land Open to Hunting | SHP | N/A | Michigan DNR, 2015 |
| State Forest, Wildlife, and Game Areas Open to Hunting | SHP | N/A | Michigan DNR, 2015 |
| State Parks Hunttable Lands | SHP | N/A | Michigan DNR, 2015 |
| ODNR Lands | SHP | N/A | Ohio DNR, 2016 |
| Great Lakes Coastal Wetland Inventory | SHP | N/A | Environment Canada, Canadian Wildlife Service - Ontario Region, U.S. Geological Service, Michigan Natural Features Inventory, Ontario Ministry of Natural Resources, 2004 |
| Coastal Wetlands Attribute Excel File | XLS | N/A | CMU Biology Department |
| Aerial Imagery (NAIP) | SID | 1 | National Agricultural Imagery Program, 2014 |
| Watershed | SHP | N/A | U.S. Department of Agriculture, Natural Resources Conservation Service, National Cartography and Geospatial Center, 2009 |
| U.S. All Roads | SHP | N/A | U.S. Department of Commerce, U.S. Census Bureau, Geography Division, 2010 (for Ohio counties) |
| Michigan All Roads | SHP | N/A | Michigan Department of Transportation, 2010 |
| Michigan Block Population and Housing Unit Counts | SHP | N/A | U.S. Census Bureau, 2010 |
| Conservation and Recreation Lands (CARL) | SHP | N/A | Ducks Unlimited, 2013 |
| TIGER American Indian Lands | SHP | N/A | U.S. Department of Commerce and U.S. Census Bureau, 2010 |

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| | | | |
|---|-----|----------------|---|
| National Conservation Easement Database | SHP | N/A | National Conservation Easement Database, 2012 |
| Federal, State, Tribal, etc. Protected Areas Land Ownership | SHP | N/A | U.S. Geological Survey Gap Analysis Program, 2011 |
| (MI) Statewide County Layer | SHP | N/A | Center for Shared Solutions, 2014 |
| (OH) County | SHP | N/A | Ohio Information Mapping System, 2014 |
| Canadian Census Boundary File | SHP | N/A | Statistics Canada Catalogue no. 92-160_X, 2011 |
| Bathymetry | TIF | ~90 | National Geophysical Data Center, NOAA, 1999 |
| Lake Huron & Lake Erie Bathy-topo | TIF | 1/9 Arc Second | National Geophysical Data Center, NOAA, 2014 |
| Invasive <i>Phragmites</i> Stands | SHP | N/A | Michigan Tech Research Institute, U.S. Geological Survey – Great Lakes Science Center, 2014 |
| USGS National Hydrography Dataset (NHD) Best Resolution for Michigan 20151104 | SHP | N/A | U.S. Geological Survey, National Geospatial Program, 2016 |
| USGS National Hydrography Dataset (NHD) Best Resolution for Ohio 20151108 | SHP | N/A | U.S. Geological Survey, National Geospatial Program, 2016 |
| 1940-2030 Housing Density (Partial Block Group Level) | SHP | N/A | Roger B. Hammer (Oregon State University), Volker C. Radeloff (University of Wisconsin Madison), and Susan I. Stewart (USDA Forest Service Northern Research Station), 2008 |