IDENTIFYING OHIO'S LAKE ERIE BASIN WETLANDS WITH HIGH-QUALITY ANIMAL HABITAT

Lake Erie Protection Fund – Project # LEPF 00-25

A FINAL METHODS REPORT SUBMITTED TO THE
OHIO LAKE ERIE COMMISSION
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Abstract: *A set of geographic information systems (GIS) shapefiles and metadata of wetlands in Ohio's Lake Erie Basin, as identified by the National Land Cover Database (NLCD1[1]) (rasterized 30 x 30 meter grid cells), were prioritized based on the potential quality of animal habitat using ten (10) criteria. The criteria were calculated from measurements using spatial datasets of wetlands, streams, roads, fish samples, land cover, and watersheds. The criteria scores for each measurement were attributed to the wetlands and then summed to identify the wetlands with the greatest potential for high-quality animal habitat for Ohio's Lake Erie basin as a whole and for each 8-digit (HUC) Hydrologic Unit.*

[1] Both the 1992 and 2001 datasets were used and processed separately

CONTENTS This compact disc contains geographic information systems (GIS) shapefiles and metadata of wetlands in Ohio's Lake Erie Basin. Wetlands as identified by the National Land Cover Database (NLCD1[2]) (rasterized 30 x 30 meter grid cells) were prioritized based on the potential quality of animal habitat using ten (10) criteria. The criteria were calculated from measurements using spatial datasets of wetlands, streams, roads, fish samples, land cover, and watersheds. The criteria scores for each measurement were attributed to the wetlands and then summed to identify the wetlands with the greatest potential for high-quality animal habitat for Ohio's Lake Erie basin as a whole and for each 8-digit (HUC) Hydrologic Unit. The user must have GIS software installed capable of reading ESRI shapefiles. GIS software is not provided here.

I. README file (this is what you are reading now; explanatory material follows this initial listing of components. You may want to print this file).

II. 1992 folder that contains the data produced using the NLCD 1992 data (All data are in Universal Transverse Mercator, Zone 17, North American Datum 1983)

A. 8-HUC folder This folder contains shapefiles of all wetlands in each of the 17 8-digit HUCs that make up Ohio's Lake Erie Basin.

WTLDS_RAW_04100001.shp
WTLDS_RAW_04100002.shp
WTLDS_RAW_04100003.shp
WTLDS_RAW_04100004.shp
WTLDS_RAW_04100005.shp
WTLDS_RAW_04100006.shp
WTLDS_RAW_04100007.shp
WTLDS_RAW_04100008.shp
WTLDS_RAW_04100009.shp
WTLDS_RAW_04100010.shp
WTLDS_RAW_04100011.shp
WTLDS_RAW_04100012.shp
WTLDS_RAW_04110001.shp
WTLDS_RAW_04110002.shp
WTLDS_RAW_04110003.shp
WTLDS_RAW_04110004.shp
WTLDS_RAW_04120101.shp

[2] Both the 1992 and 2001 datasets were used and processed separately

1. grids folder This folder contains grids of all wetlands in each of the 17 8-digit HUCs that make up Ohio's Lake Erie Basin.

WT_RW04100001
WT_RW04100002
WT_RW04100003
WT_RW04100004
WT_RW04100005
WT_RW04100006
WT_RW04100007
WT_RW04100008
WT_RW04100009
WT_RW04100010
WT_RW04100011
WT_RW04100012
WT_RW04110001
WT_RW04110002
WT_RW04110003
WT_RW04110004
WT_RW04120101

B. 95tile_8-HUC folder This folder contains shapefiles of the wetlands that are in the 95th percentile (see **95th Percentile Calculation Section**) for *Total_crit* (the sum of the 10 criteria scores) in each of the 17 8-digit HUCs that make up Ohio's Lake Erie Basin.

WTLDS_95tile_04100001.shp
WTLDS_95tile _04100002.shp
WTLDS_95tile _04100003.shp
WTLDS_95tile _04100004.shp
WTLDS_95tile _04100005.shp
WTLDS_95tile _04100006.shp
WTLDS_95tile _04100007.shp
WTLDS_95tile _04100008.shp
WTLDS_95tile _04100009.shp
WTLDS_95tile _04100010.shp
WTLDS_95tile _04100011.shp
WTLDS_95tile _04100012.shp
WTLDS_95tile _04110001.shp
WTLDS_95tile _04110002.shp
WTLDS_95tile _04110003.shp
WTLDS_95tile _04110004.shp
WTLDS_95tile _04120101.shp

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WT95_04100001
WT95_04100002
WT95_04100003
WT95_04100004
WT95_04100005
WT95_04100006
WT95_04100007
WT95_04100008
WT95_04100009
WT95_04100010
WT95_04100011
WT95_04100012
WT95_04110001
WT95_04110002
WT95_04110003
WT95_04110004
WT95_04120101

C. lake_erie folder This folder contains 2 shapefiles: all wetlands in Ohio's Lake Erie Basin AND the wetlands that are in the 95th percentile (see **95th Percentile Calculation Section**) for *Total_crit* (the sum of the 10 criteria scores) in Ohio's Lake Erie Basin, respectively.

final_wetlands_nlcd1992.shp
95tile_final_wetlands_nlcd1992.shp

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fn_wt_nlcd_92
fn95wt_nlcd92

D. metadata folder This folder contains .htm files that contain metadata for each of the shapefiles.

III. 2001 folder that contains the data produced using the NLCD 2001 data (All data are in Universal Transverse Mercator, Zone 17, North American Datum 1983)

A. 8-HUC folder — This folder contains shapefiles of all wetlands in each of the 17 8-digit HUCs that make up Ohio's Lake Erie Basin.

WTLDS_RAW_04100001.shp
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WTLDS_RAW_04100004.shp
WTLDS_RAW_04100005.shp
WTLDS_RAW_04100006.shp
WTLDS_RAW_04100007.shp
WTLDS_RAW_04100008.shp
WTLDS_RAW_04100009.shp
WTLDS_RAW_04100010.shp
WTLDS_RAW_04100011.shp
WTLDS_RAW_04100012.shp
WTLDS_RAW_04110001.shp
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WTLDS_RAW_04110003.shp
WTLDS_RAW_04110004.shp
WTLDS_RAW_04120101.shp

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WTLDS_95tile _04110004.shp
WTLDS_95tile _04120101.shp

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WT95_04110004
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C. lake_erie folder — This folder contains 2 shapefiles: all wetlands in Ohio's Lake Erie Basin AND the wetlands that are in the 95th percentile (see **95th Percentile Calculation Section**) for *Total_crit* (the sum of the 10 criteria scores) in Ohio's Lake Erie Basin, respectively.

final_wetlands_nlcd2001.shp
95tile_final_wetlands_nlcd2001.shp

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fn_wt_nlcd_01
fn95wt_nlcd01

D. metadata folder — This folder contains .htm files that contain metadata for each of the shapefiles.

Identifying Potential High-Quality Wetland Habitat

Source Data:

Wetlands
Wetlands were identified using the National Land Cover Database (NLCD) (Multi-Resolution Land Characteristics (MRLC) Consortium). Two separate analyses were performed using the 1992 and 2001 NLCD datasets [http://www.mrlc.gov/index.asp].

For NLCD 1992: wetlands are defined and classified as:

> Areas where the soil or substrate is periodically saturated with or covered with water as defined by Cowardin et al.
>
> 91. Woody Wetlands - Areas where forest or shrubland vegetation accounts for 25-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.
>
> 92. Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for 75-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.

Using the NLCD 2001, wetlands are defined and classified as:

> 90. Woody Wetlands: Woody Wetlands are areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
>
> 95. Emergent Herbaceous Wetlands. Emergent Herbaceous Wetlands are areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Streams
Perennial and intermittent streams were identified using the National Hydrography Dataset (NHD) (USGS and USEPA, [http://nhd.usgs.gov/])

Roads
Roads were identified using the 2006 Second Edition TIGER/Line® Files (US Census Bureau, [http://www.census.gov/geo/www/tiger/tiger2006se/tgr2006se.html])

Fish Samples
The number of fish species collected from each 14-digit HUC was calculated by the Ohio Aquatic GAP Project [http://oh.water.usgs.gov/ohgap.htm] using a compiled dataset of fish samples from the Ohio Environmental Protection Agency, Ohio Department of Natural Resources, and Ohio Department of Transportation.

Watersheds
Large watersheds (USGS 8-digit HUCs) were used to assess the wetland measurements.

Measurements and Criteria:
Measurements and criteria were taken directly from Sutter, L.A. 2001. "Spatial Wetland Assessment for Management and Planning (SWAMP): Technical Discussion." NOAA Coastal Services Center. Publication No. 20129-CD. Charleston, South Carolina, USA, unless otherwise noted with the criteria. Measurements, as used here, means those measurements that can be calculated using GIS; e.g. association with surface water. The criteria represent the results of these measurements that indicate differing degrees of wetland habitat "quality"; e.g. adjacent to permanent surface water, adjacent to intermittent stream, or not adjacent to surface water. The following list shows the 10 measurements and criteria along with the measurement field name (in italics) used in the attribute tables of the shapefiles. Criteria field names are the same as the measurement fields, but have an "Le" in front that stands for Lake Erie.

1.) Overall wetland size *(Acres)*

Measurement
This is the area of each wetland group in acres.

Criteria
1 = (≥50 acres)
0 = (< 50 acres)

from the Ohio Rapid Assessment Method for Wetlands: Version 5.0

Method
Using NLCD wetland data, I grouped all wetland cells (using the Region Group tool in ESRI ArcMap) of the same class if they were touching each other (including diagonal cells). The groupings were kept if greater than 5 acres. Each grouping was given a unique identifying number. This grid was called [wtld_lker_reg].

2.) Interior size of habitat *(Intrior)*

Measurement
This is the area of each wetland group in acres measured from 100 meters inside of the wetland group border.

Criteria
1 = (≥ 74 acres)
0 = (< 74 acres)

Method
Using [wtld_lker_reg] from (1.) above, I ran gridpoly command in GRID (ArcInfo). This created a grid [prmtr_poly] that calculated perimeters. In ArcView, I ran the View>Geoprocessing Wizard>Dissolve features based on an attribute tool on the [prmtr_poly] based on the grid-code. This gave me a shapefile [A.shp]of all the wetland groupings. Then, in ArcMap, I ran the buffer analysis tool using (-100 meters). This gave me a shapefile [B.shp] of all the wetlands groupings minus a 100 meter-buffer around the perimeter. I used the calculate area tool on [B.shp] to give me a shapefile [C.shp] that had area in square meters as an attribute.

3.) Association with Surface Water *(Adj_per)*

Measurement

This measurement identifies wetland groups that are adjacent (grid cells touch) to water bodies (includes reservoirs, lakes, ponds) as identified by the NHD.

1 = wetland groups adjacent to a perennial water body.
2 = wetland groups adjacent to an intermittent water body.
3 = all remaining wetland groups indicating their isolation from water bodies

Criteria

1 = (wetland groups adjacent to a perennial water body)
0 = (wetland groups not adjacent to a perennial water body)

Method

In ArcMap, I used the clip (analysis) tool to clip the National Hydrography Dataset (NHD) watersheds by major drainage basins. There were four watershed groupings [A, B, C, D]. I also did this for the waterbody features (ponds, lakes, reservoirs) of the NHD [wtr1, wtr2, wtr3, wtr4]. I also did this for water area features (outlines of large rivers) of the NHD [big_riv1, big_riv2, big_riv3, big_riv4]. Each reach [A, B, C, D] or polygon [wtr1, wtr2, wtr3, wtr4, big_riv1, big_riv2, big_riv3, big_riv4] is given an Fcode that describes it. Some are described as intermittent or perennial. In Arcview, I used the Theme>Select by Theme>Intersect tool using [Prmtr_poly] coverage (the feature-based version of the [wtld_lker_reg] grid. I linked this attribute table to [perimeter.dbf] using grid-code. I then linked [perimeter.dbf] to the attribute table of [wtld_lker_reg]. I selected all the perennial objects from [A, B, C, D, wtr1, wtr2, wtr3, wtr4, big_riv1, big_riv2, big_riv3, big_riv4] and saved as shapefiles. I then intersected each of these to [Prmtr_poly] which highlighted [wtld_lker_reg] wetlands that were thus, perennial. I coded these 1 in a new field in [wtld_lker_reg] as Adjcnt_pmnt. I repeated these steps but with intermittent objects. I coded these in [wtld_lker_reg] as 2. The remaining wetland groupings were given a 3. If more than one situation occurred, a 1 trumped a 2.

4.) Proximity to Perennial Stream *(Buff100)*

Measurement

This measurement identifies wetland groups that are in proximity (within 100 meters, but not necessarily touching) to perennial and intermittent streams as identified by the NHD.

1 = wetland groups within 100 meters of a perennial stream.
2 = wetland groups that were within 100 meters of an intermittent stream.
3 = all remaining wetland groups indicating their isolation from streams.

Criteria

1 = (wetland groups within 100 meters of a perennial stream)
0 = (wetland groups not within 100 meters of a perennial stream)

Method

In ArcView, I used the Theme>Select by Theme>Intersect tool using [A, B, C, D] from (3.) above. I intersected with [big_riv1, big_riv2, big_riv3, big_riv4] and attributed [A, B, C, D] F-code as perennial. I then buffered the perennial streams by 100 meters. I also buffered streams [A, B, C, D] that were classified as paths (ponds, lakes, reservoirs). In ArcView, I again used the Theme>Select by Theme>Intersect tool using a linkage of datasets [Prmtr_poly] to [perimeter.dbf] to [wtld_lker_reg]. I intersected with buffer shapefiles and coded new field, "buffer100" in [wtld_lker_reg] as 1. I did the same thing for intermittent objects (streams,13 and canals, 19; I didn't do paths connectors because they hook large streams to smaller ones and would have been included in perennial streams buffer).

5.) Wetland Juxtaposition *(Border)*

Measurement

This is the percentage of wetlands that border (are adjacent to) each wetland group of the other type.

Criteria

1 = (> 50 percent bordered by wetlands)
0 = (≤ 50 percent bordered by wetlands)

Method

In ArcView, I made new grids [wtld_lker_reg] based on wetland type ([wtld1] for this discussion). In ArcMap, I imported [wtld1] and ran Conversion>Raster to Polygon (*Don't Simplify!*). I then ran the resulting .shp in Dissolve by gridcode. Then, I ran the resulting .shp in buffer. 30 meters and dissolve set to none. In ArcView, I imported the new buffer .shp. I made a new grid from the NLCD grid using all values but the wetland in question [no1nlcd]. I also made a grid containing nothing but the opposite wetland in question [just2]. I took the buffer .shp and selected by gridcode and made new, smaller .shp's. Then, I ran the Analysis>Summary tool with the smaller buffer .shp highlighted. I summarized the [no1nlcd]. This gave me a table. I did this for each of the smaller buffer .shp's. Then, I linked the summary table to the smaller buffer .shp attribute table via gridcode. In the summary table, I sorted in ascending order the Count field. There were some wetland groupings that got split or clipped when the Lake Erie drainage basin data got clipped. Because of this, some wetland groupings did not

have complete coverage by NLCD data within the buffered area. For example, a one-celled wetland grouping should have 8 cells surrounding it. If it was on the edge and got clipped, there might have only been 5 cells in the buffered area. I deleted these from every grid or .shp. I made a copy of all of them and merged them into one grid [dltd_wtlds]. Next, I copied the field Count and named it old_nlcd. This was done to prevent mess-ups when joined to another table that had the field Count. Then, I used the Analysis>Summary tool on the smaller buffer .shp's again, but this time, I used the [just2] grid. This gave me the number of wetlands in [wtld2] surrounding a wetland. This gave me a summary table. I joined the first summary table to the new summary table via gridcode. I then made a new field called old_brdr which was Count/old_nlcd or surrounding wetlands cells/ total of all surrounding cells. This gave me a value less than one which represents the percentage of surrounding cells that represent wetlands. I did this for all of the smaller .shp's. I joined the new summary table to the [wtld_lker_reg] and created a new column to house the percentage data called Wtld_brdr.

6.) Surrounding habitat (> 50 percent) *(Hbt)*

Measurement

This is a measurement of the percentage of natural vegetation land cover that surrounds each wetland group (within a 150 meter buffer).

Criteria

1 = (> 50 percent of surrounding land cover composed of natural vegetation)

0 = (≤ 50 percent of surrounding land cover composed of natural vegetation)

Method

In ArcView, I buffered a polygon version of wetlands by 150 meters. I then used Analysis>Tabulate Areas tool with buffered .shp and NLCD. I totaled all land uses. I subtracted each wetlands own area from the total. I then calculated an area of all of the natural vegetation (NLCD codes 40s, 50s, 70s, and 90s). I divided natural vegetation area by total area to get a percentage.

7.) Surrounding habitat (> 90 percent) *Hbt)*

Measurement
This is a measurement of the percentage of natural vegetation land cover that surrounds each wetland group (within a 150 meter buffer).

Criteria
1 = (> 90 percent of surrounding land cover composed of natural vegetation)
0 = (≤ 90 percent of surrounding land cover composed of natural vegetation)

Method
In ArcView, I buffered a polygon version of wetlands by 150 meters. I then used Analysis>Tabulate Areas tool with buffered .shp and NLCD. I totaled all land uses. I subtracted each wetlands own area from the total. I then calculated an area of all of the natural vegetation (NLCD codes 40s, 50s, 70s, and 90s). I divided natural vegetation area by total area to get a percentage.

8.) Distance to closest wetland *(Dist)*

Measurement
This is a measurement of the proximity of wetland groups to other wetland groups.

1 = wetland groups that were adjacent to other wetland groups.
2 = wetland groups that were less than 0.5 miles from another wetland group.
3 = all remaining wetland groups indicating their isolation from other wetland groups.

Criteria
1 = (wetland groups that were either adjacent to other wetland groups or were less than 0.5 miles from another wetland group)
0 = (wetland groups that were greater than 0.5 miles from another wetland group)

Method
I used an ArcView extension (center of mass by www.jennessent.com) on [Prmtr_poly] that calculated the true centroid of a polygon. Open .dbf distance table for editing and select distance field=0. Then I summarized Input_fid field by distance=minimum. I joined to .shp center of mass and added a new field, copied, and converted to miles. Then, in ArcMap, I imported .shp of center of mass and coded Dist_wtld by adjacent wetland groupings = 1, < 0.5 miles = 2, and > 0.5 miles = 3.

9.) Cumulative length of roads within 1 kilometer of wetland *(Roads)*

Measurement

This is the cumulative length of roads in miles as identified by U.S. Census Bureau Tigerline data calculated within a one (1) kilometer buffer area around each wetland group.

Criteria

1 = (upper third percentile of road lengths in assessment unit (Ohio's Lake Erie Basin as a whole or for each 8-digit HUC)

0 = (lower two-thirds percentile of road lengths in assessment unit)

From Faunal aspects of wetland creation and restoration, Deni Porej, 2004.

Method

I downloaded the new 2007 TIGER data for the 36 counties in the Ohio portion of the Lake Erie drainage basin. In ArcMap, I converted the TIGER files to coverages using the basic TIGER conversion tool. I exported the acode table to a .dbf file. I then, converted the coverages to shapefiles. I imported the shapefiles and .dbf tables into ArcView. I linked the shapefiles and .dbf tables and selected the CFCC = a and p (roads). I saved the selected lines as a new shapefile. I did this for each county. I merged all of the county shapefiles and then projected to UTM zone 17 [merged_wetlands.shp].I used a polygon .shp to buffer each wetland by 1 kilometer. I clipped the [merged roads.shp] to the buffered areas. Then in ArcMap, I opened the clipped roads table for editing, created a new field "length", calculate, clicked advance, and typed this:

```
Dim dblLength as double
Dim pCurve as ICurve
Set pCurve = [shape]
dblLength = pCurve.Length
```

dblLength in last box

I then joined the buffered areas with the clipped roads and created a SUM field that gave me length of all roads within the buffered area. I imported this output .shp into ArcView and converted length to miles. I joined the table to the [wtld_lker_reg]. This was done in portions of the original wetland dataset for processing.

10.) Number of fish species (for riverine wetlands) collect from same 8-digit HUC *(Fsh_rch)*

Measurement
This is the number of unique, native fish species collected by various Federal and state agencies within the 8-digit HUC that the wetland group lays.

Criteria
1 = (upper third percentile of number of species in assessment unit (Ohio's Lake Erie Basin as a whole or for each 8-digit HUC)
0 = (lower two-thirds percentile of number of species in assessment unit)

Not from Sutter, L.A. 2001.

Method
In ArcView, I used the View>Geoprocessing Wizard>Spatial Join tool using a .shp of 14-digit HUCs attributed with total number of native fish species from the Ohio GAP Project and a polygon .shp of wetlands. I made a new field in wetlands .shp and copied the number of fish species. Some wetlands groupings straddled two 14-digit HUCs. To fix this, I used the higher of the two fish species number. For those wetland groupings that were not riverine (Adjcnt_pmnt = 3), I coded new field (called Fish_richness) with 9999.

Other fields in attribute tables:

Gridcode – Wetland grid cells from the raster NLCD dataset were grouped and assigned an identification number if they were the same class of wetland and were adjacent to each other. This analysis looks at wetland groupings which differ from wetlands in that there may be several wetland groupings within a known wetland complex. Two wetland groupings may only be separated by one grid cell (not adjacent to one another).

The Gridcode is a unique identification number assigned to each wetland grouping.

Count – This is the number of grid cells grouped together and assigned the same Gridcode.

Wtld_type –This is the NLCD classification code given to identify the type of land cover. In this project, there are two wetland types identified for the NLCD 2001 (90 and 95) and two wetland types identified for the NLCD 1992 (91 and 92).

Acres –This is the area of each wetland group in acres.

Perimeter –This is the perimeter of each wetland group in meters.

Edgetoarea –This is the ratio of Perimeter to Area. This measurement was originally going to be used to identify potential high-quality habitat wetlands, but was later dropped because no criteria could be developed for Ohio wetland types using this measurement. It was developed to identify high-quality tidal wetlands.

Total_crit –This is the sum of the 10 criteria scores. Higher scores are assumed to indentify wetlands with a potentially higher quality of habitat.

95th Percentile Calculation:

Sutter, L.A. 2001. "Spatial Wetland Assessment for Management and Planning (SWAMP): Technical Discussion." NOAA Coastal Services Center. Publication No. 20129-CD. Charleston, South Carolina, USA, states that "Overall habitat quality is highest where biodiversity is highest, i.e., the more habitat requirements a wetland fills for the greatest number of species, the higher is its habitat significance." This statement should be kept in mind when using the 95th percentile data.

For each of the 10 measurements, a score of 1 was assigned to a wetland if it met the criteria (a score of 0 was given, otherwise). The sum of all 10 criteria scores was calculated producing a number between 0 and 10. Habitat requirements differ for each species, so a summed criteria score of 3 does not necessarily mean it is better habitat for a particular species than a score of 2. Higher scores simply mean that more criteria were met.

For each area of analysis, all of the summed criteria scores of each wetland were used to choose the top 5% (or 95th percentile). These wetlands represent those with the greatest potential for high-quality animal habitat.

These assessments should be viewed as coarse-representations of individual wetlands and should be tested via site-specific examination or other means.