# Construction of a Geographic Information System for Wildlife Refuge Planning:

# Ottawa National Wildlife Refuge Complex[1]

by

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## Background

Under the National Wildlife Refuge System Improvement Act of 1997 (http://refuges.fws.gov/NWRSFiles/ Legislation/HR1420/TOC.html) the U.S. Fish and Wildlife Service (USFWS) is required to develop Comprehensive Conservation Plans (CCP) for the management of lands under its jurisdiction. This legislation has introduced the need for more complete, geo-referenced digital data coverage for each of the USFWS national wildlife refuges. Region 3 of the USFWS comprises an eight-state area (figure 1) and includes approximately fifty refuges. Section 7 of the Committee Report from the National Wildlife Refuge System Improvement Act of 1997 (http://refuges.fws.gov/NWRSFiles/Legislation/HR1420/Part4.html) describes the following five areas which must be included in each national wildlife refuge CCP:

- The purposes of the refuge
- The fish, wildlife and plant populations, their habitats, and the archaeological and cultural values found on the refuge
- Significant problems that may adversely affect wildlife populations and habitats and ways to correct or mitigate those problems
- Areas suitable for administrative sites or visitor facilities
- Opportunities for fish- and wildlife-dependent recreation


Figure 1. Region 3 of the U.S. Fish and Wildlife Service.

To assist in planning for USFWS lands contributing to the conservation of biological diversity and to the structure and function of the ecosystem in which they are located, it is important for each refuge to acquire, analyze and present resource management planning data in a geographic information system (GIS).

**Common Procedures**

Working cooperatively with the USFWS, the University of Minnesota Department of Forest Resources has been compiling geo-referenced data for each national wildlife refuge in USFWS Region 3 since the fall of 1997. A standardized list of data sets has been developed (Appendix A). Actual data layers acquired differ among refuges depending on availability and USFWS instruction. Data have been collected from various local, state and federal agencies, academic, professional and government Internet sites and some private companies. In some instances, students have gathered refuge data using Global Positioning System (GPS) technology. Much of the data have been available at no cost, and other data have been purchased by the USFWS. Research Assistants have been working with GIS and imaging software programs from ESRI (Arc/Info, Arcview) and ERDAS (Imagine) on both NT and Unix workstations.

In addition to the spatial data layers, students are also creating metadata text files which describe each data set, its sources, and processing procedures. One metadata text file is created for each coverage. This has been done using a combination of software tools available from the Internet. First, the spatial extent (or bounding coordinates) of a coverage is found using an Arcview Extension (http://www.fws.gov/ data/avmeta.html). Second, a metadata entry program called Corpsmet95 from the U.S. Corps of Engineers (http://corpsgeo1.usace.army.mil /welcome.html) is used for the majority of file creation; Corpsmet95 is FGDC compatible. Finally, the program MetaParser from the U.S. Geological Survey (USGS) (http://geology.usgs.gov/tools/metadata /tools/doc/mp.html) is used to check the metadata text file for errors and/or reformat the file. When a refuge's data are delivered to the USFWS, each metadata file is located with its corresponding data file. Final data collections and corresponding metadata files are delivered to the USFWS on CD-ROM with brief text description files included on each CD (Table 1 and Appendix B provide examples).

**Table 1. Data set naming standards for the Ottawa National Wildlife Refuge Complex.**

| Ottawa NWR Dataset Name | Directory Name | Shape file names & metadata text file |
|---|---|---|
| ***Root Directory*** | ***/OTW*** | |
| ***Basemap Data*** | ***/BASEMAP*** | |
| Digital Raster Graphics (DRGs) | **/DRGs** | du-drgs \| nu-drgs \| ou-drgs |
| Floodplain Boundaries | **/Floodpl** | du-flood \| nu-flood \| ou-flood |
| Hydrography | **/Hydro** | du-hydro \| nu-hydro \| ou-hydro |
| Land Cover | **/Lulc** | ou-lulc |
| National Wetlands Inventory (NWI) | **/NWI** | nu-nwi |
| Soils | **/Soils** | du-soils \| nu-soils \| ou-soils |
| Transportation | **/Trans** | |
| Roads | | du-roads \| nu-roads \| ou-roads |
| ***Project Data*** *(Specific to Refuge)* | ***/OTWMAP*** | |
| Tracts | **/Tracts** | dutrac \| nutrac \| outrac |
| Management plans (Ottawa Division) | **/MgmtPlns** | |
| Crop Units | | |
| Unit 2 | | cu2 |
| Unit 6 | | cu6 |
| Unit 9 and 10 | | cu9-10 |
| Unit 11 and 12 | | cu11-12 |
| Moist Soil Units | | Msoils |
| Deer Management Zones | | Deerzones |
| Photos | **/Photos** | du-photos \| nu-photos \| ou-photos |
| Project Boundary | **/Prjbnd** | |
| Refuge Boundary (Legislative) | | duleg \| nuleg \| ouleg |
| Real Property Inventory | **/RPIProp** | |
| Points | **/Points** | |
| Parking Areas \| Headquarters | | otw-parking \| otw-hq |

| Cedar Point NWR Dataset Name | Directory Name | Shape file names & metadata text file |
|---|---|---|
| ***Root Directory*** | ***/CDP*** | |
| ***Basemap Data*** | ***/BASEMAP*** | |
| Digital Raster Graphics (DRGs) | **/DRGs** | cdp-drgs |
| Floodplain Boundaries | **/Floodpl** | cdp-flood |
| Hydrography | **/Hydro** | cdp-hydro |
| Soils | **/Soils** | cdp-soils |
| Transportation | **/Trans** | |
| Roads | | cdp-roads |
| ***Project Data*** *(Specific to Refuge)* | ***/CDPMAP*** | |
| Tracts | **/Tracts** | Cdptrac |
| Photos | **/Photos** | cdp-photos |
| Project Boundary | **/Prjbnd** | |
| Refuge Boundary (Legislative) | | cdpleg |

| West Sister Island NWR Dataset Name | Directory Name | Shape file names & metadata text file |
|---|---|---|
| ***Root Directory*** | ***/WTS*** | |
| ***Basemap Data*** | ***/BASEMAP*** | |
| Digital Raster Graphics (DRGs) | **/DRGs** | wts-drgs |
| ***Project Data*** *(Specific to Refuge)* | ***/WTSMAP*** | |
| Project Boundary | **/Prjbnd** | |
| Refuge Boundary (Legislative) | | wtsleg |

All of the GIS data layers and metadata files created for the USFWS Region 3 are intended to be operationally useful; in addition, the refuge boundaries adhere to specifications of the U.S. Fish and Wildlife Service Lands Boundary Data Standard Operating Procedures (SOP Number 97-01). Data sets specific to the refuge require field verification by refuge staff familiar with the refuge lands. As noted in each metadata file, the intended application of the boundary data is to serve as a spatial reference for other data layers in GIS and mapping applications. It is not intended to be used as a land survey or representation of land for conveyance or tax purposes. The data are not legal documents and are not intended to be used as such. It is the responsibility of the user to use the data appropriately and consistently, recognizing its limitations.

**Ottawa National Wildlife Refuge Complex**

The Ottawa National Wildlife Refuge Complex is comprised of three refuges: Ottawa NWR, Cedar Point NWR and West Sister Island NWR. The Complex is located in northern Ohio on the shore of Lake Erie in Lucas and Ottawa Counties. Ottawa NWR was established in 1961 and contains three units: Ottawa, Navarre and Darby covering 5,794 acres. Cedar Point NWR, covering 2,445 acres, was donated to the Service and established in 1964. West Sister Island NWR was established by Executive Order 7937 in 1937. All 77 acres of West Sister Island NWR were designated as wilderness in 1975. The Complex lands are located in the western Lake Erie basin wetlands, which lie at the intersection of the Mississippi and Atlantic flyways. Ottawa NWR is a major migration corridor and stopover area for migrating waterfowl and other birds. Public uses of the refuges include environmental education, wildlife observation, hiking, and hunting, fishing and trapping. The Ottawa National Wildlife Refuge Complex provides appropriate habitat for waterfowl and other wildlife (http://www.fws.gov/r3pao/ottawa/). Current management practices include wetland restoration, water and moist soil management, cooperative farming, outreach and environmental education. Planning for the coordination of these activities will be enhanced through the acquisition and use of geo-referenced data.

The GIS data collected for the Ottawa National Wildlife Refuge Complex span five extents (figure 2). Each extent buffers the refuge boundary by approximately one mile. The data sets in Table 2 span the refuge extent under which they are listed. The majority

of the data sets in Table 2 are considered basemap layers and can be used for map production, spatial reference, and resource management.

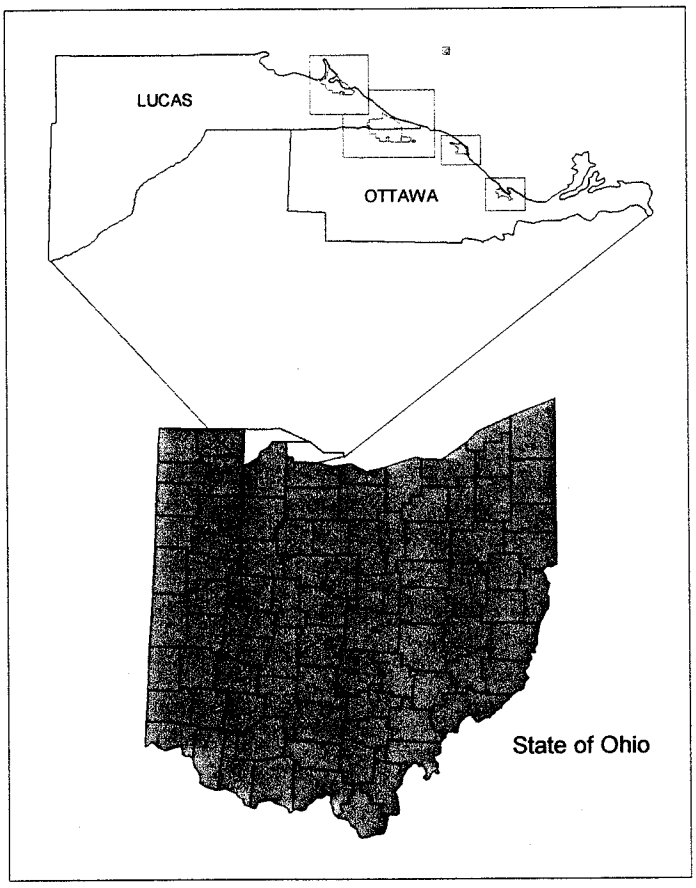


Figure 2. Two county area encompassing the Ottawa National Wildlife Refuge Complex with the location of the refuge authorized boundaries. Also shown are the extent of data collection.

Each layer of data can be combined and analyzed in different ways to reveal spatial relationships between different themes. By combining the mosaiced DRGs (scanned USGS topographic maps) and a digital, geo-referenced boundary file we can produce a portion of the map used for refuge boundary review by USFWS Region 3, Division of Realty and Refuge staff (figure 3). Other useful information could include placing refuge and tract ownership boundaries shown over a color photo mosaic (figure 4). Some land cover change analysis can also be done with the land cover/historical vegetation layer

**Table 2. Summary list of data layers for the Ottawa National Wildlife Refuge Complex.[a]**

| Data Set Name | Brief Description |
|---|---|
| **Ottawa NWR** | |
| **Darby Unit** | |
| Floodplain Boundaries | FEMA data from the Ohio DNR |
| Hydrography | DLG data from the USGS |
| Digital Raster Graphics (DRGs) | 7.5-minute DRGs obtained from USFWS, Region 3 |
| Soils | Soils data from the Ohio DNR |
| Roads | DLG data from the USGS |
| Tract ownership | Internal tracts of ownership |
| Color IR Photos | Mosaiced color photographic image |
| Refuge Boundary (Authorized) | Authorized refuge unit boundary |
| **Navarre Unit** | |
| Floodplain Boundaries | FEMA data from the Ohio DNR |
| Hydrography | DLG data from the USGS |
| Digital Raster Graphics (DRGs) | 7.5-minute DRGs obtained from USFWS, Region 3 |
| National Wetlands Inventory (NWI) | National Wetlands Inventory from FWS |
| Soils | Soils data from the Ohio DNR |
| Roads | DLG data from the USGS |
| Tract ownership | Internal tracts of ownership |
| Color IR Photos | Mosaiced color photographic image |
| Refuge Boundary (Authorized) | Authorized refuge unit boundary |
| **Ottawa Unit** | |
| Floodplain Boundaries | FEMA data from the Ohio DNR |
| Hydrography | DLG data from the USGS |
| Digital Raster Graphics (DRGs) | 7.5-minute DRGs obtained from USFWS, Region 3 |
| Land Cover | Developed from the USFWS Cropland Management Plan 1994 |
| Soils | Soils data from the Ohio DNR |
| Roads | DLG data from the USGS |
| Tract ownership | Internal tracts of ownership |
| Cropland Management Units | Developed from the USFWS Cropland Management Plan 1994 |
| Moist Soil Units | Developed from the USFWS Cropland Management Plan 1994 |
| Deer Management Zones | Developed from the USFWS Cropland Management Plan 1994 |
| Color IR Photos | Mosaiced color photographic image |
| Refuge Boundary (Authorized) | Authorized refuge unit boundaries |
| Parking Areas | Developed from the USFWS Cropland Management Plan 1994 |
| Headquarters | Developed from the USFWS Cropland Management Plan 1994 |

**Table 2. Continued**

| Data Set Name | Brief Description |
|---|---|
| **Cedar Point NWR** | |
| Floodplain Boundaries | FEMA data from the Ohio DNR |
| Hydrography | DLG data from the USGS |
| Digital Raster Graphics (DRGs) | 7.5-minute DRGs obtained from USFWS, Region 3 |
| Soils | Soils data from the Ohio DNR |
| Roads | DLG data from the USGS |
| Tract ownership | Internal tracts of ownership |
| Color IR Photos | Mosaiced color photographic image |
| Refuge Boundary (Authorized) | Authorized refuge boundary |
| **West Sister Island NWR** | |
| Digital Raster Graphics (DRGs) | 7.5-minute DRGs obtained from USFWS, Region 3 |
| Tract ownership | Internal tracts of ownership |

[a] All the data are geo-referenced to UTM Zone 17 with a datum of NAD83. The data consist of one CD-Roms.

(figure 5). The database for the land cover layer could also be queried to show specific land conversion that occurred between 1972 and 1994 to land cover polygons. The land cover data layer, as well as several other data layers, could now be updated yearly to track land cover and other change in the refuge. As refuge staff become more familiar with GIS, many maps and analyses can be produced to assist in enhancing natural resource management activities at each refuge of the Ottawa National Wildlife Refuge Complex.

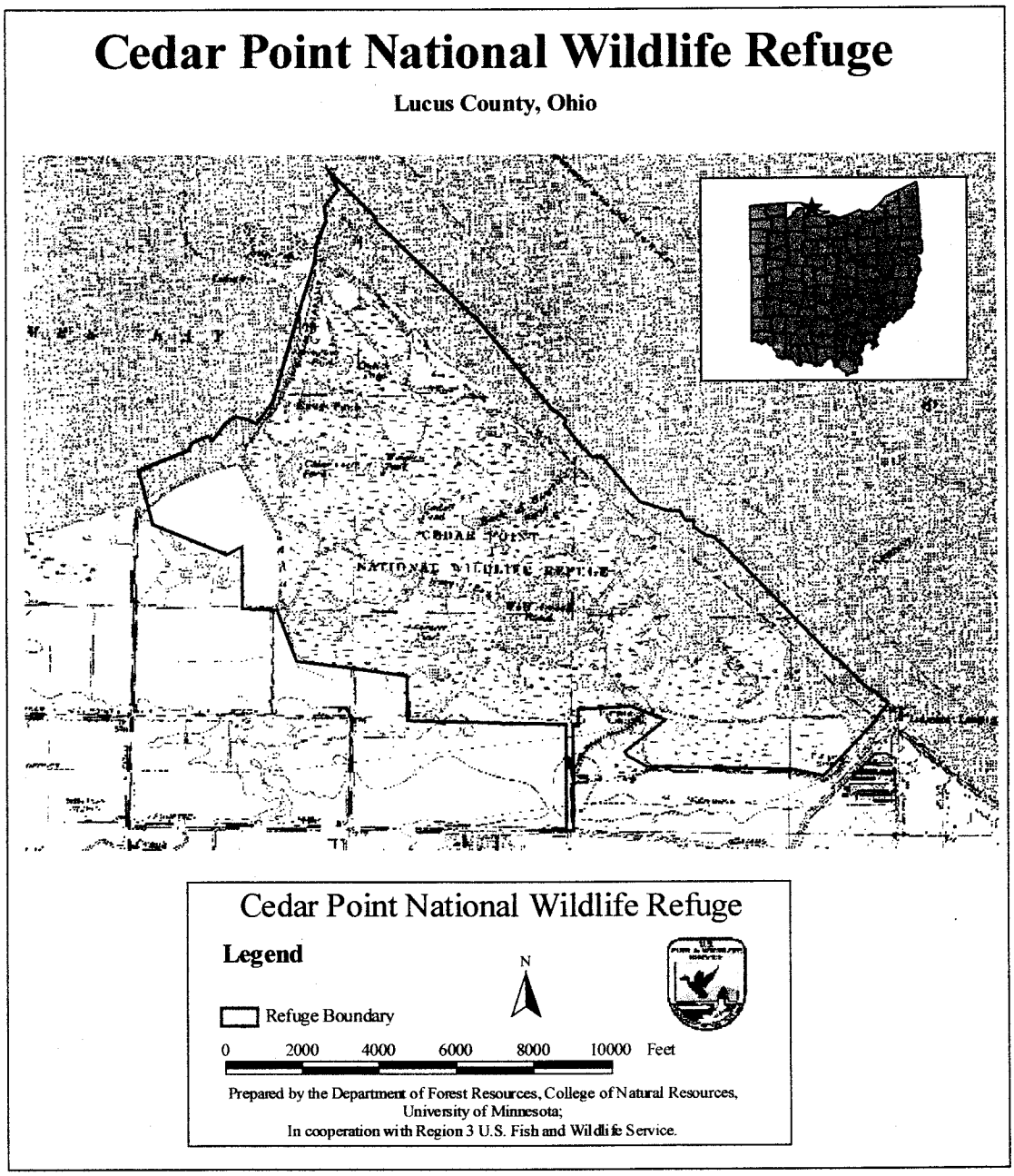


Figure 3. One refuge of the Ottawa National Wildlife Refuge Complex, overlaid on USGS 7.5-minute topographic map data.

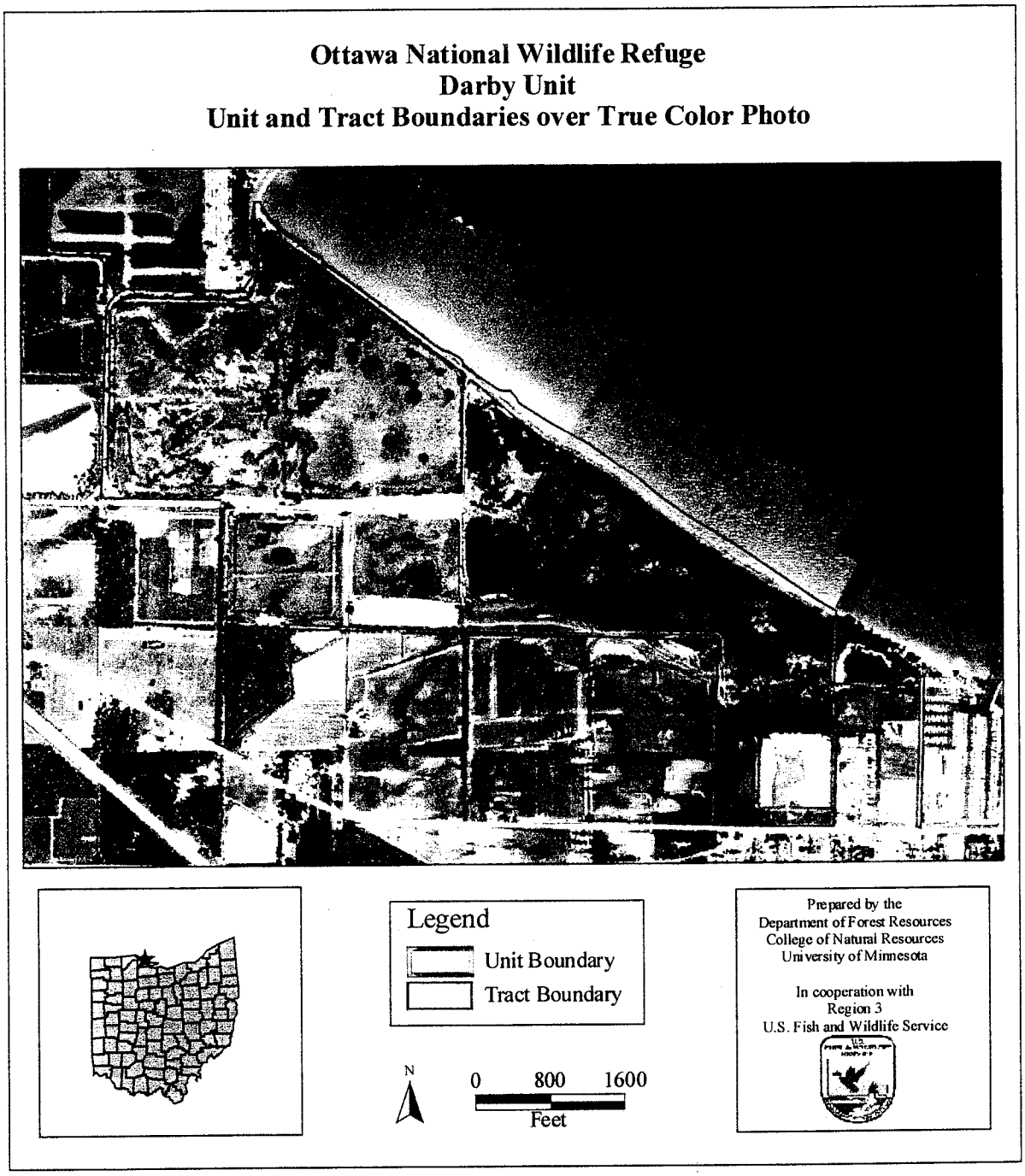


Figure 4. Map of unit and tract boundaries developed at the University of Minnesota for the Darby Unit of the Ottawa National Wildlife Refuge.

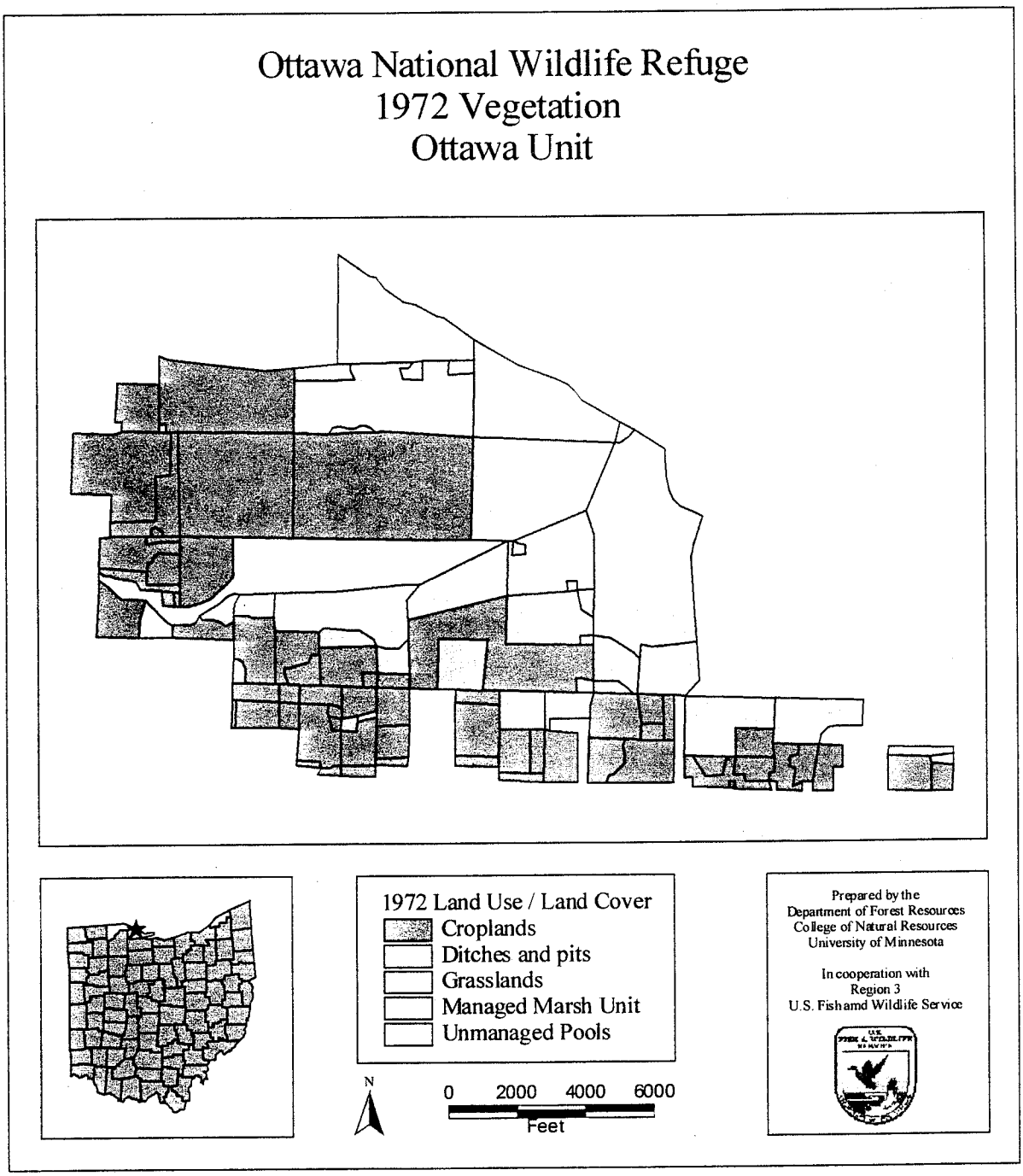


Figure 5. Map of 1972 vegetation collected at the University of Minnesota for the Ottawa Unit of Ottawa National Wildlife Refuge.

## Appendix A: National wildlife refuge GIS inventory (April 1999 draft).

| Data Types from USFWS | Status / Notes | Source | Resolution | MetaData |
|---|---|---|---|---|
| ***Basemap Data*** | | | | |
| Digital Elevation Models (DEMs) | | | | |
| Digital Orthophoto Quadrangles (DOQs) | | | | |
| Digital Raster Graphics (DRGs) | | | | |
| Floodplain Boundaries (100yr and 500yr - FEMA) | | | | |
| Historical Vegetation | | | | |
| Hydrography | | | | |
| Lakes | | | | |
| Streams | | | | |
| Land Cover | | | | |
| Land Ownership (Other Public Lands) | | | | |
| Land Use | | | | |
| Natural Heritage Data | | | | |
| National Wetlands Inventory (NWI) | | | | |
| Political Boundaries | | | | |
| Cities / Municipal Boundaries | | | | |
| Civil Townships | | | | |
| Congressional Districts | | | | |
| County | | | | |
| State | | | | |
| Zoning | | | | |
| Public Land Survey | | | | |
| PLS Sections | | | | |
| Soils | | | | |
| Transportation | | | | |
| Airports | | | | |
| Railroads | | | | |
| Roads (may have different types) | | | | |
| Watersheds | | | | |
| Watersheds \| Watershed Basins | | | | |
| ***Project Data (Specific to Refuge)*** | | ***Existing Refuge*** | | |
| Cultural | | | | |
| Archeological Sites | | | | |
| Fish Habitat | | | | |
| Critical Habitat | | | | |
| Stormwater Sewers | | | | |
| Land cover (more detailed than above) | | | | |
| Tracts (Internal tract boundaries) | | | | |
| Management plans | | | | |
| Burn Units | | | | |
| Cropland Management Plan | | | | |
| Future Planning | | | | |
| Photos | | | | |
| Project Boundary | | | | |
| Refuge Boundary (Authorized \| Expansion ) | | | | |
| WPAs \| Easements ... | | | | |
| Public Recreation | | | | |
| Fish Access \| Boat Access \| Parks ... | | | | |
| Real Property Inventory | | | | |
| Signs \| Structures \| Water Control Structures... | | | | |
| Hiking Trails \| Dikes \| Drainage Ditches ... | | | | |
| Parking Areas ... | | | | |
| Wildlife Habitats | | | | |
| Eagle \| Herons ... | | | | |
| *Note: Additional datasets may be requested* | | | | |

## Appendix B. Text file description on CD-Rom for Ottawa National Wildlife Refuge Complex data (May 1999).

**Documentation:**
This CD contains GIS data for the National Wildlife Refuges of Cedar Point, Ottawa and West Sister Island. These Refuges are located in Lucas and Ottawa Counties, Ohio.

**Overall Description:**
This CD contains Basemap Layers and Refuge Specific Layers.
The various geo-referenced data exists as either shape files, Arc/Info coverages, and/or Tiff files. There are also metadata files (a detailed description) of each data layer. These metadata files can be found in each directory as .met files, which match up with a data layer. All data are geo-referenced to UTM Zone 17 with a datum of NAD83.

## Ottawa National Wildlife Refuge Data

**/otw/basemap/drgs**

This directory contains the TIFF format files of the Digital Raster Graphics (drgs) for Units of Ottawa NWR. The file **du-drgs** is the file for the Darby Unit. The file **nu-drgs** is the file for the Navarre Unit. The file **ou-drgs** is the file for the Ottawa Unit.

**/otw/basemap/floodpl**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for the flood data for the Units of Ottawa NWR. The file **du-flood** is the file for the Darby Unit. The file **nu-flood** is the file for the Navarre Unit. The file **ou-flood** is the file for the Ottawa Unit of Ottawa NWR.

**/otw/basemap/hydro**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for the hydrography data for the Units of Ottawa NWR. The file **du-hydro** is the file for the Darby Unit. The file **nu-hydro** is the file for the Navarre Unit. The file **ou-hydro** is the file for the Ottawa Unit of Ottawa NWR.

**/otw/basemap/lulc**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for the land use/ land cover data for the Ottawa Unit of Ottawa NWR. The file **ou-lulc** is the file for the land use/land cover of the Ottawa Unit of Ottawa NWR.

**/otw/basemap/nwi**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for the National Wetlands Inventory data for the Navarre Unit of Ottawa NWR. The file **nu-nwi** is the file for the NWI data of the Navarre Unit of Ottawa NWR.

**/otw/basemap/soils**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for the soils data for the Units of Ottawa NWR. The file **du-soils** is the file for the Darby Unit. The file **nu-soils** is the file for the Navarre Unit. The file **ou-soils** is the file for the Ottawa Unit of Ottawa NWR.

**/otw/basemap/trans**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for the roads data for the Units of Ottawa NWR. The file **du-roads** is the file for the Darby Unit. The file **nu-roads** is the file for the Navarre Unit. The file **ou-roads** is the file for the Ottawa Unit of Ottawa NWR.

**/otw/otwmap/tracts**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for the internal tract boundary data for the Units of Ottawa NWR. The file **dutrac** is the file for the Darby Unit. The file **nutrac** is the file for the Navarre Unit. The file **outrac** is the file for the Ottawa Unit of Ottawa NWR.

**/otw/otwmap/mgmtplns**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for management plan data for the Ottawa Unit of Ottawa NWR. The file **cu2** is the file for the crop management layer of crop unit 2. The file **cu6** is the file for the crop management layer of crop unit 6. The file **cu9-10** is the file for the crop management layer of crop units 9 and 10. The file **cu11-12** is the file for the crop management layer of crop units 11 and 12. The file **msoils** is the file for the moist soil units found in the Ottawa Unit of Ottawa NWR. The file **deerzones** is the file for the deer management zones in the Ottawa Unit.

**/otw/otwmap/photos**

This directory contains the image files for the color aerial photos that cover the Units of Ottawa NWR. The file **du-photos** is the file for the Darby Unit. The file **nu-photos** is the file for the Navarre Unit. The file **ou-photos** is the file for the Ottawa Unit of Ottawa NWR.

**/otw/otwmap/prjbnd**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for legislative boundaries of the Units of Ottawa NWR. The file **duleg** is the file for the Darby Unit. The file **nuleg** is the file for the Navarre Unit. The file **ouleg** is the file for the Ottawa Unit of Ottawa NWR.

**/otw/otwmap/rpiprop/points**

This directory contains the ArcInfo export file formats as well as ArcView Shapefiles for real property inventoy data for the Ottawa Unit of Ottawa NWR. The file **otw-parking** is the point file for the parking areas in the Ottawa Unit. The file **otw-hq** is the point file for the location of headquarters in the Ottawa Unit of Ottawa NWR.

## Cedar Point National Wildlife Refuge Data

**/cdp/basemap/drgs**

This directory contains the TIFF format file, **cdp-drgs**, of the Digital Raster Graphics (drgs) for Cedar Point NWR.

**/cdp/basemap/floodpl**

This directory contains the ArcInfo export file format as well as ArcView Shapefile, **cdp-flood**, of the flood data for Cedar Point NWR.

**/cdp/basemap/hydro**

This directory contains the ArcInfo export file format as well as ArcView Shapefile, **cdp-hydro**, of the hydrography data for Cedar Point NWR.

**/cdp/basemap/soils**

This directory contains the ArcInfo export file format as well as ArcView Shapefile, **cdp-soils**, of the soil data for Cedar Point NWR.

**/cdp/basemap/trans**

This directory contains the ArcInfo export file format as well as ArcView Shapefile, **cdp-roads**, of the road data for Cedar Point NWR.

**/cdp/cdpmap/tracts**

This directory contains the ArcInfo export file format as well as ArcView Shapefile, **cdp-trac**, of the internal tract boundaries for Cedar Point NWR.

**/cdp/cdpmap/photos**

This directory contains the image file, **cdp-photos**, for the color aerial photos that cover Cedar Point NWR.

**/cdp/cdpmap/prjbnd**

This directory contains the ArcInfo export file format as well as ArcView Shapefile, **cdpleg**, for legislative boundary of Cedar Point NWR

## West Sister Island National Wildlife Refuge Data

**/wts/basemap/drgs**

This directory contains the TIFF format file, **wts-drgs**, of the Digital Raster Graphics (drgs) for West Sister Island NWR.

**/wts/wtsmap/prjbnd**

This directory contains the ArcInfo export file format as well as ArcView Shapefile, **wtsleg**, for legislative boundary of West Sister Island NWR