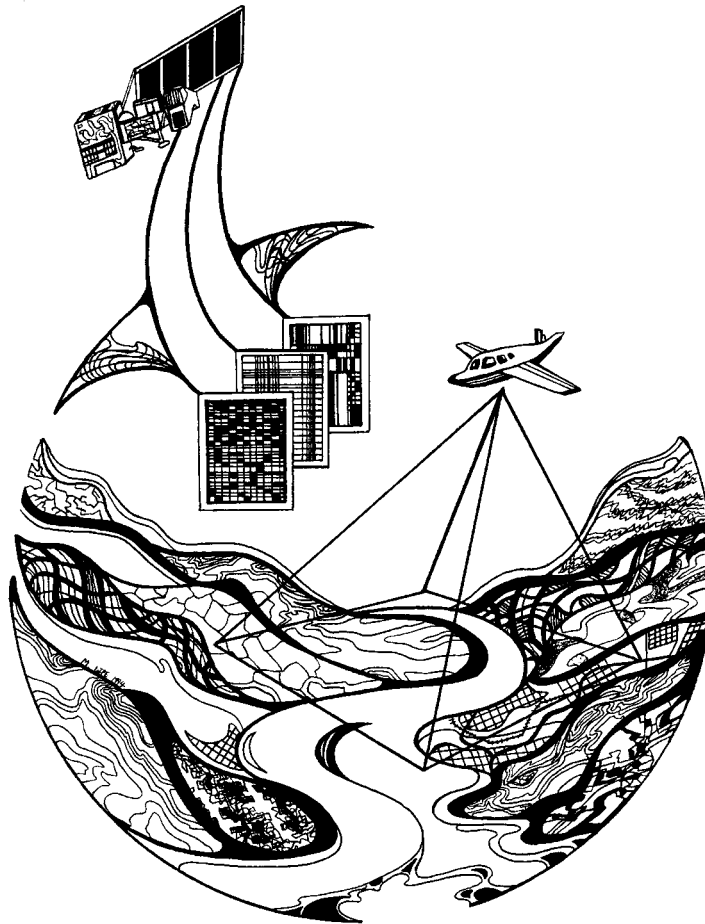


Long Term Resource Monitoring Program

Program Report

95-P005

Geospatial Application: Refuge Expansion Acreage Analysis



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August 1995

Geospatial Application: Refuge Expansion Acreage Analysis

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Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' Environmental Management Program. The LTRMP is being implemented by the Environmental Management Technical Center, an office of the National Biological Service, in cooperation with the five Upper Mississippi River System (UMRS) states, Illinois, Iowa, Minnesota, Missouri, and Wisconsin, with guidance and Program responsibility provided by the U.S. Army Corps of Engineers. The UMRS encompasses the commercially navigable reaches of the Upper Mississippi River, as well as the Illinois River and navigable portions of the Kaskaskia, Black, St. Croix, and Minnesota Rivers.

The mission of the LTRMP is to provide decision makers with information to maintain the UMRS as a sustainable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and impacts, develop management alternatives, manage information, and develop useful products.

The strategy to conduct spatial analysis to provide support to LTRMP partner activities is included in the LTRMP Operating Plan (USFWS 1992) as Strategy 4.3.1, *Develop Data Management and Analysis Capabilities*, Task 4.3.1.2, *Develop, Maintain and Enhance Geographic Information Systems and Remote Sensing Analysis Capabilities*. This document was prepared for individuals experienced in using the geographic information system software program ARC/INFO. No attempt has been made to instruct users in the concepts associated with file structure, program modules, database development, digitizing, or map-making procedures. This report was developed with funding provided by the Long Term Resource Monitoring Program.

Additional copies of this report may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (1-800-553-6847).

This report should be cited as:

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Geospatial Application: Refuge Expansion Acreage Analysis

By Lara Hill

Abstract

Resource managers are realizing the benefits of using geographic information systems to supply visual spatial data for use in making informed management decisions. This report details the ARC/INFO (ESRI, Redlands, CA) procedures used at the Environmental Management Technical Center in Onalaska, Wisconsin, to assist Upper Mississippi River National Wildlife and Fish Refuge managers in the process of acquiring refuge land through a land exchange. Refuge managers required boundaries for both 430- and 500-acre parcels that included the most desirable land cover/use types. Hardcopy maps of the area showing the total acreage for each land cover/use type will be used during land exchange negotiations.

Introduction

The Upper Mississippi River National Wildlife and Fish Refuge was established by an Act of Congress on June 7, 1924. The original acreage for the Refuge was acquired through purchase, donation, and by withdrawal from the public domain. The area was later enlarged by additional land acquisitions of the U.S. Army Corps of Engineers for navigational improvements. Today, the Refuge consists of about 200,000 acres of wooded islands, waters, and marshes extending more than 260 miles southward along the river bottoms from Wabasha, Minnesota, almost to Rock Island, Illinois. The river bottoms forming the Refuge are from 2 to 5 miles wide. Eleven locks and dams within Refuge boundaries form a series of pools that vary from 10 to 30 miles long. The dams have raised water levels, creating a maze of channels, sloughs, marshlands, and open lakes. Excellent stands of aquatic plants developed in these areas, creating valuable habitat for waterfowl and other wildlife. The Refuge is divided into four management districts, including the La Crosse District in La Crosse, Wisconsin, which manages Pools 7 and 8.

The Refuge was acquiring land in the La Crosse District through an exchange with Newt Marine, Dubuque, Iowa. The company owns a low-lying farm in Houston County bordering the Refuge and the Root River (Fig. 1), the exact acreage of which was unknown before this project. Depending on the final agreement, the exchange will involve the

transfer of all, 430, or 500 acres of this land to the Refuge. The amount of the exchange will be determined by the land appraisal on both sites. The La Crosse District Refuge Manager requested technical assistance from the Environmental Management Technical Center (EMTC), a National Biological Service office in Onalaska, Wisconsin, to assist Refuge staff in determining which parcels to obtain. The request was for development of boundaries for the entire farm, 430-, and 500-acre parcels that included the most desirable land cover/use types for wildlife, and that acreage reports be calculated for each land cover/use type.

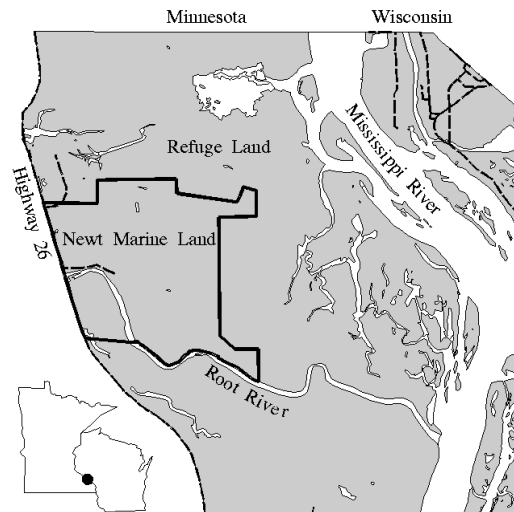


Figure 1. Location of farm parcel to be acquired through land exchange

Objective

The objective of this project was to create boundaries for the entire farm, 430-, and 500-acre parcels and produce hardcopy maps and reports to be used in the land exchange negotiations, using geographic information system (GIS) technology and the EMTC's spatial data.

Methods

The computer hardware and software used for this project (located at the EMTC) include a Unix workstation and ARC/INFO version 6.1.2 (ESRI, Redlands, CA) GIS software.

Because of the scope of this project, we decided to use the 1989 Pool 8 land cover/use coverage available in the EMTC database, generalizing the data into seven classes. This decision saved considerable time and effort, since new photos did not have to be interpreted and digitized to create new ARC/INFO coverages. For more detailed information on the development of the 1989 coverage, see the Metadata Catalog of Spatial Data for the Upper Mississippi River System Long Term Resource Monitoring Program (D'Erchia 1993). For information on the seven-class generalization process, see Appendix A.

Since adequate coverage of the study area was available, only the boundary creation process and the area report procedures will be discussed in detail. This document was prepared for individuals experienced in using the GIS software program ARC/INFO. No attempt has been made to instruct users in the concepts associated with file structure, program modules, database development, digitizing, or map-making procedures.

Processing steps are written in normal type, ARC/INFO commands in the descriptions are underlined>, ARC/INFO prompts and responses are in *italic* type, and user commands are in normal **bold** type.

1. The first step was to digitize Refuge and land boundaries drawn on a U.S. Geological Survey (USGS) 7.5-min quadrangle supplied by the Refuge. The farm boundary coverage "farmclip" is shown below (Fig. 2).

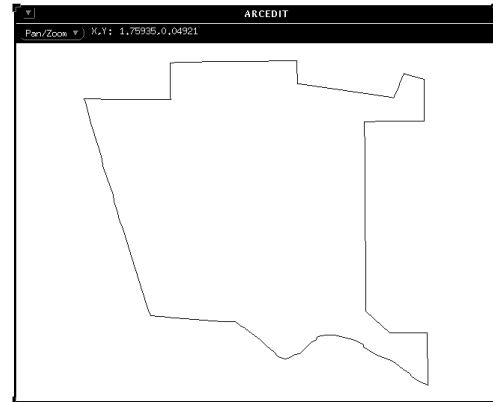


Figure 2. Farm boundary digitized from U.S. Geological Survey 7.5-min quadrangle

2. The digitized land boundary coverage "farmclip" was used as a cookie cutter to clip the land cover/use data from the 1989 coverage. The new coverage "farmlcu" contains the seven land cover/use types from the original coverage within the farm boundary (Fig. 3). The procedures for the ARC clip command are shown below.

```
Arc: clip
Usage: CLIP <in_cover> <clip_cover> <out_cover>
{POLY | LINE | POINT | NET | LINK | RAW}
{fuzzy_tolerance}
Arc: clip lcup8 farmclip farmlcu
Clipping lcup8 with farmclip to create farmlcu.
Sorting...
Intersecting...
Assembling polygons...
Creating new labels...
Creating /HOME/LRH0/refuge_EXT/FARMLCU.PAT...
O v e r l a y i n g   a n n o t a t i o n . . .
```

3. The new coverage (Fig. 4) was displayed in ARCPLOT to verify the outcome of the clip command. The mapextent is set for the new

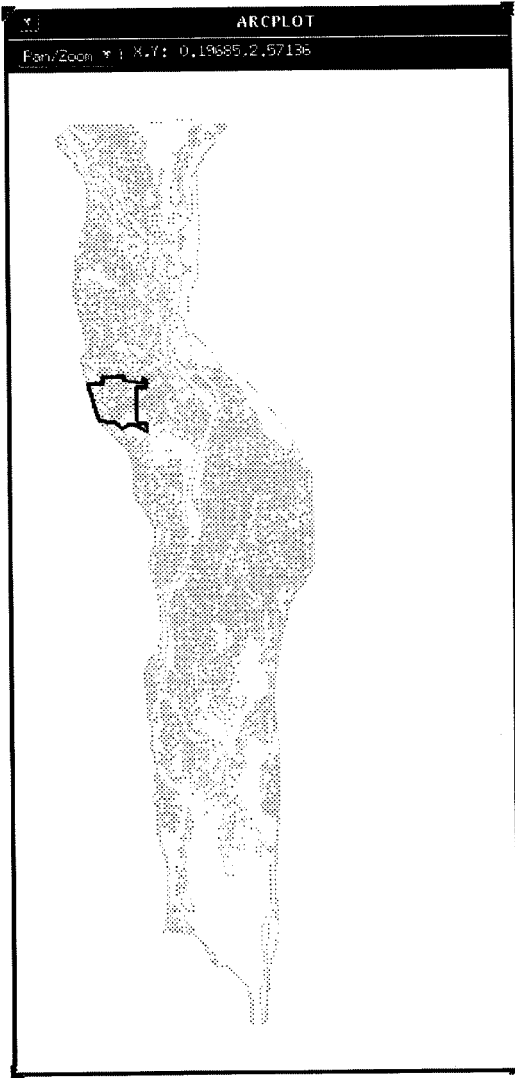


Figure 3. Digitized farm boundary overlaying Pool 8 1989 land cover/use coverage

coverage and the `arcs` command draws the line coverage on screen. A `list` displays the items, and the coverage is shaded on the item "symbol" using the `polygonshades` command.

```
Arc: arcplot
Arcplot: mapextent farmlcu
Arcplot: arcs farmlcu
```

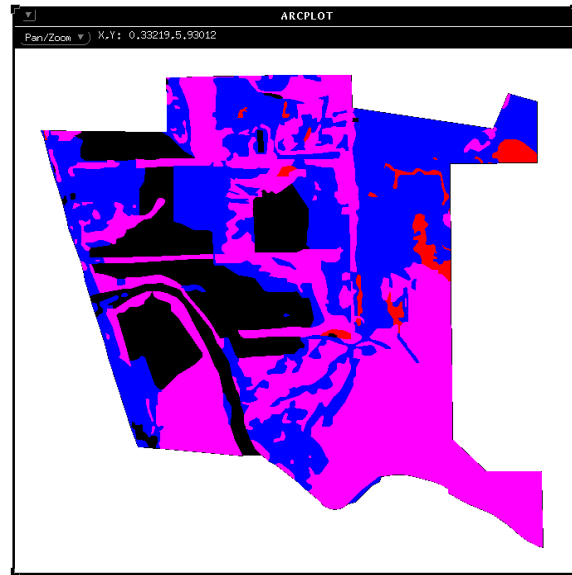


Figure 4. The clipped coverage containing the seven land cover/use types

```
Arcplot: list
Usage: LIST <cover> <feature_class> {range}
      {item...item}
Arcplot: list farmlcu poly
      1
AREA = -2687317.01651
PERIMETER = 8664.28507
FARMLCU# = 1
FARMLCU-ID = 0
LANDCOVER/USE =
TYPE_DESCRIPTION =
SYMBOL = 0
CLASS = 0
      2
AREA = 2796.46741
PERIMETER = 336.32970
FARMLCU# = 2
FARMLCU-ID = 1686
LANDCOVER/USE = 80SD3
TYPE_DESCRIPTION = Acer-marsh-seasonal
SYMBOL = 74
CLASS = 4
Continue? n
Arcplot: polygonshades
Usage: POLYGONSHADES <cover> <item | symbol>
      {lookup_table}{angle_item | angle}
Arcplot: shadeset colornames
Arcplot: polygonshades farmlcu symbol
```

- An area report for the farm was generated, showing the total acreage for each land

cover/use type and total acreage for the entire farm parcel. The ARC command frequency produces a list of unique code occurrences and their frequency for a specified set of items in an INFO data file. In INFO, the frequency file is selected, and a reselect and nselect are performed to remove the universal polygon. The area is then calculated from meters squared to acres, and a textfile is created using the INFO report command. The report is displayed using the Unix more command. The procedures for creating an area report of this type are shown below.

Arc: **frequency farmlcu.pat farmlcu.xxx**

Enter Frequency item names (type END or a blank line when done):

```
=====
Enter the 1st item: class
Enter the 2nd item:
Done entering item names (Y/N)? y
Do you wish to use the above items (Y/N)? y
```

Enter Summary item names (type END or a blank line when done):

```
=====
Enter the 1st item: area
Enter the 2nd item:
Done entering item names (Y/N)? y
Do you wish to use the above items (Y/N)? y
```

Arc: **info**

```
Submitting command arc info
INFO EXCHANGE CALL
11/03/1994 15:26:06
INFO 9.42 11/11/86 52.74.63*
COPYRIGHT 1986 HENCO SOFTWARE, INC.
PROPRIETARY TO HENCO SOFTWARE, INC.
US GOVT AGENCIES SEE USAGE RESTRICTIONS IN
HELP FILES (HELP RESTRICTIONS)
ENTER USER NAME>ARC
```

```
ENTER COMMAND >SELECT FARMLCU.XXX
7 RECORD(S) SELECTED
```

```
ENTER COMMAND >RESELECT AREA < 0
1 RECORD(S) SELECTED
```

```
ENTER COMMAND >NSELECT
6 RECORD(S) SELECTED
```

```
ENTER COMMAND > CALC AREA = AREA / 10000
ENTER COMMAND > CALC AREA = AREA * 2.471
```

```
ENTER COMMAND >OUTPUT
/net/suns02/home/lrh0/refuge_ext/farmlcu.sum
```

```
ENTER COMMAND >REPORT FARMLCU.RPX
```

```
2 ENTER COLUMN CONTENT>CLASS
ENTER REPORT OPTIONS>20
ENTER COLUMN HEADINGS>CLASS
ENTER COLUMN HEADINGS>
```

```
22 ENTER COLUMN CONTENT>FREQUENCY
ENTER REPORT OPTIONS>T
ENTER COLUMN HEADINGS>FREQ.
ENTER COLUMN HEADINGS>
```

```
28 ENTER COLUMN CONTENT>AREA
ENTER REPORT OPTIONS>T
ENTER COLUMN HEADINGS>ACRES
ENTER COLUMN HEADINGS>
```

```
47 ENTER COLUMN CONTENT>
ENTER REPORT TITLE>'FARMLCU AREA REPORT'
DO YOU WISH TO EXECUTE THIS FORM ( Y OR N )
>y
OUTPUT TO PRINTER(Y OR N)?>y
LINES PER PAGE?>
ENTER REPORT OPTIONS>
```

```
ENTER COMMAND >ERASE FARMLCU.RPX
THIS COMMAND WILL ERASE THE SPECIFIED RP
DO YOU WISH TO CONTINUE ( Y OR N ) >Y
```

```
ENTER COMMAND >ERASE FARMLCU.XXX
THIS COMMAND WILL ERASE THE SPECIFIED DF
DO YOU WISH TO CONTINUE ( Y OR N ) >y
```

```
ENTER COMMAND >Q STOP
```

```
Arc: more farmlcu.sum
Submitting command to Operating System ...
03/11/94 PAGE 1
```

FARMLCU AREA REPORT

CLASS	FREQ.	ACRES
1	9	6.54646
2	19	14.73890
3	49	244.83015
4	92	277.51846
6	5	106.82538
7	4	3.57667
	=====	=====
	178	664.03603

- In ARCEDIT, the coverage "farmlcu" was used to create the 430-acre tic boundary for a new coverage and as a backgroundcoverage while digitizing on screen. An effort was made to fulfill the following objectives when digitizing: to create straight uncomplicated boundaries, to avoid dissecting fields, to locate the boundary along identifiable features, to

include the most desirable areas from a wildlife habitat perspective (i.e., wetlands and forests over farm fields), and to leave the remaining farm parcel in one contiguous piece surrounding the buildings (Fig. 5). A color plot of the farm that displayed the land cover/use classes served as a visual aid while selecting boundaries.

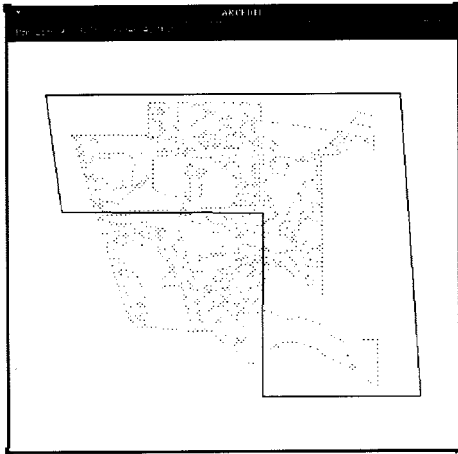


Figure 5. A proposed boundary digitized on screen in ARCEDIT

First, the necessary ARCEDIT setup commands are performed: the backgroundcoverage is set to "farmlcu" color 4 blue, the backgroundenvironment is set to arcs, the editfeature is set to arcs, and the drawenvironment is set to arcs. The intersectarcs all command allows all digitized arcs to automatically intersect, which enables the dangling ends to be selected and deleted.

```
Arc: arcedit
Arcedit: create clip1 farmlcu
Creating /HOME/LRH0/refuge_EXT/CLIP1
The edit coverage is now /HOME/LRH0/refuge_EXT/CLIP1
WARNING the Map extent is not defined
Defaulting the map extent to the BND of
/HOME/LRH0/refuge_EXT/CLIP1
Arcedit: backgroundcoverage farmlcu 4
/HOME/LRH0/refuge_EXT/FARMLCU
is now background coverage 1 with draw symbol 4
Arcedit: backgroundenvironment arcs
```

```
Arcedit: draw
Arcedit: editfeature arcs
0 element(s) for edit feature ARCS
Coverage has no COGO attributes
Arcedit: drawenvironment arcs
Arcedit: intersectarcs all
Arcedit: add
-----Options-----
1) Vertex      2) Node      3) Curve
4) Delete vertex 5) Delete arc  6) Spline on/off
7) Square on/off 8) Digitizing Options 9) Quit
(Line) User-ID: 1 Points 7
2 intersection(s) found while adding arc
(Line) User-ID: 2 Points ---
1 arc(s) added to /HOME/LRH0/refuge_EXT/CLIP1
Arcedit: save
Saving changes for /HOME/LRH0/refuge_EXT/CLIP1
Saving arcs...
3 arc(s) written to /HOME/LRH0/refuge_EXT/CLIP1
from the original 0, 3 added and 0 deleted
Reopening arcs...
BND replaced into /HOME/LRH0/refuge_EXT/CLIP1
Re-establishing edit feature
Arcedit: select dangle
2 element(s) now selected
Arcedit: delete
2 arc(s) deleted
Arcedit: save
Saving changes for /HOME/LRH0/refuge_EXT/CLIP1
Saving arcs...
1 arc(s) written to /HOME/LRH0/refuge_EXT/CLIP1
from the original 3, 0 added and 2 deleted
Reopening arcs...
BND replaced into /HOME/LRH0/refuge_EXT/CLIP1
Re-establishing edit feature
Arcedit: q
```

6. The new coverage "clip1" was then cleaned in ARC to create topology.

```
Arc: clean
Usage: CLEAN <in_cover> {out_cover} {dangle_length}
{fuzzy_tolerance}{POLY | LINE}
Arc: clean clip1
Cleaning /HOME/LRH0/refuge_EXT/CLIP1
Sorting...
Intersecting...
Assembling polygons...
```

7. As explained in detail in Step 2, the proposed boundary coverage was clipped in ARC with the farm coverage to produce a land cover/use coverage within the boundary of the clip.

```
Arc: clip
Usage: CLIP <in_cover> <clip_cover> <out_cover>
{POLY | LINE | POINT | NET | LINK | RAW}
{fuzzy_tolerance}
Arc: clip farmlcu clip1 clip1lcu
Clipping farmlcu with clip1 to create clip1lcu.
```

Sorting...
 Intersecting...
 Assembling polygons...
 Creating new labels...
 Creating /HOME/LRH0/refuge_EXT/clip1lcu.PAT...
 O v e r l a y i n g a n n o t a t i o n . . .

CLASS	FREQ.	ACRES
1	6	1.35970
2	18	13.90085
3	38	83.73305
4	66	81.47626
6	4	49.52666
7	1	0.12581
=====		=====
133		430.12233

- ARCPLLOT was used to view the new coverage and verify the clip procedure (Fig. 6).

Arc: **arcplot**
 Arcplot: **mapextent farm1lcu**
 Arcplot: **arcs farm1lcu**

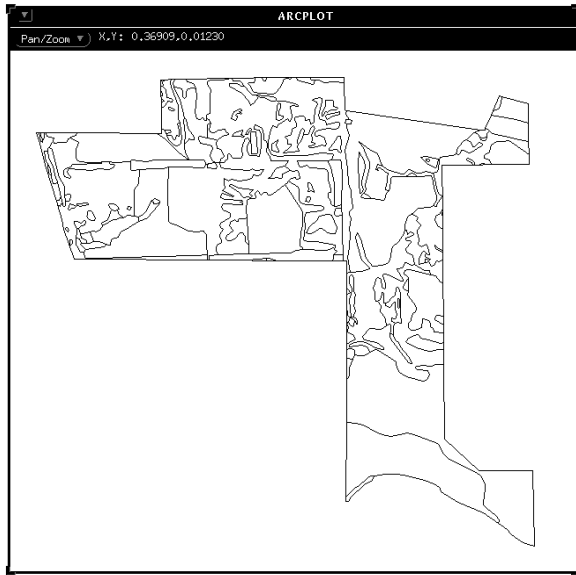


Figure 6. Proposed boundary coverage clipped with farm boundary coverage

- As shown in detail in Step 4, an area report was created showing total acreage for each land cover/use type. Steps 5 through 8 were repeated until trial and error determined the requested boundary to within 1 acre.

03/11/94 PAGE 1
 CLIP1LCU AREA REPORT

- To ensure more efficient repetition of these processes, steps 5 through 8 were automated using a very basic ARC Macro Language (AML) program (Appendix B).

Results

The information generated by this GIS application will be used by Refuge managers to decide on a final boundary during land exchange negotiations. Maps displaying the whole farm, a 430-, and a 500-acre parcel were created in ARCPLLOT, with their accompanying area reports (Appendix C). The AML will allow Refuge managers with little or no ARC/INFO training to adjust the boundaries once the land exchange is final.

Geographic information systems are useful tools for addressing natural resource issues. This project demonstrates the value of GIS applications to resource managers and provides specific procedures for ARC users tasked with similar projects.

References

D'Erchia, F. 1993. Metadata catalog of spatial data for the Upper Mississippi River System Long Term Resource Monitoring Program. U.S. Fish and Wildlife Service, Environmental Management Technical Center, Onalaska, Wisconsin, November 1993. Revised by the National Biological Survey, April 1994. EMTC 93-P009. 75 pp.

Olsen, D. A. 1993. User's manual: Production ARCEDIT. U.S. Fish and Wildlife Service, Environmental Management Technical Center, Onalaska, Wisconsin, September 1993. EMTC 93-P005 15 pp. + Appendix A + diskette.

U.S. Fish and Wildlife Service. 1992. Operating Plan for the Upper Mississippi River System Long Term Resource Monitoring Program. Environmental Management Technical Center, Onalaska, Wisconsin, Revised September 1993. EMTC 91-P002. 179 pp. (NTIS #PB94-160199)

Appendix A

Generalization of 13 Class Coverages to 7 Classes

Arc: list lcu89p8.pat

```

1
AREA          = -154077988.37665
PERIMETER     =      81156.43696
LCU89P8#     = 1
LCU89P8-ID   = 0
NWL_CODE     =
LCU          =
LCU-13       =
EPPL_CODE    = 0
CLASS        = 0
VEG_CODE     = 0
PERCENT_CLOSURE =
TREE_HEIGHT  =
  
```

```

2
AREA          = 7207.20691
PERIMETER     = 589.31481
LCU89P8#     = 2
LCU89P8-ID   = 1
NWL_CODE     = PFO1Ah
LCU          = Acer
LCU-13       = Woody Terrestrial
EPPL_CODE    = 76
CLASS        = 10
Continue?
VEG_CODE     = 1001
PERCENT_CLOSURE = >90
TREE_HEIGHT  = >50
  
```

Arc: **additem**

Usage: ADDITEM <in_info_file> <out_info_file> <item_name> <item_width>
 <output_width> <item_type> {decimal_places} {start_item}

Arc: **additem lcu89p8.pat lcu89p8.pat class7 3 3 i**

Adding class7 to lcu89p8.pat to produce lcu89p8.pat.

Arc: **items lcu89p8.pat**

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	ALTERNATE NAME	INDEXED?
1	AREA	8		18	F	5	-
9	PERIMETER	8		18	F	5	-
17	LCU89P8#	4		5	B	-	-
21	LCU89P8-ID	4		5	B	-	-
25	NWL_CODE	8		8	C	-	-
33	LCU	30		30	C	-	-
63	LCU-13	30		30	C	-	-
93	EPPL_CODE	3		3	I	-	-
96	CLASS	3		3	I	-	-
99	VEG_CODE	4		4	I	-	-
103	PERCENT_CLOSURE	5		5	C	-	-
108	TREE_HEIGHT	5		5	C	-	-
113	CLASS7	3		3	I	-	-

Arc: **info**

INFO EXCHANGE CALL

24/02/1995 09:36:57

INFO 9.42 11/11/86 52.74.63*

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ENTER USER NAME>ARC

ENTER COMMAND >SEL LCU89P8.PAT
8061 RECORD(S) SELECTED

ENTER COMMAND >RES CLASS = 1
58 RECORD(S) SELECTED

ENTER COMMAND > CALC CLASS7 = 1

ENTER COMMAND > ASEL
8061 RECORD(S) SELECTED

ENTER COMMAND >RES CLASS = 2 OR CLASS = 3 OR CLASS = 4 OR CLASS = 5 OR CLASS = 6 OR CLASS = 7 OR CLASS = 8
3798 RECORD(S) SELECTED

ENTER COMMAND >CALC CLASS7 = 2

ENTER COMMAND >ASEL
8061 RECORD(S) SELECTED

ENTER COMMAND >RES CLASS = 9
1658 RECORD(S) SELECTED

ENTER COMMAND >CALC CLASS7 = 3

ENTER COMMAND >ASEL
8061 RECORD(S) SELECTED

ENTER COMMAND >RES CLASS = 10
2348 RECORD(S) SELECTED

ENTER COMMAND >ASEL
8061 RECORD(S) SELECTED

ENTER COMMAND >RES CLASS = 10
2348 RECORD(S) SELECTED

ENTER COMMAND >CALC CLASS7 = 4

ENTER COMMAND >ASEL
8061 RECORD(S) SELECTED

ENTER COMMAND >RES CLASS = 11
14 RECORD(S) SELECTED

ENTER COMMAND >CALC CLASS7 = 5

ENTER COMMAND >ASEL
8061 RECORD(S) SELECTED

ENTER COMMAND >RES CLASS = 12
87 RECORD(S) SELECTED

ENTER COMMAND >CALC CLASS7 = 6

ENTER COMMAND >ASEL
8061 RECORD(S) SELECTED

ENTER COMMAND >RES CLASS = 13
97 RECORD(S) SELECTED

ENTER COMMAND >CALC CLASS7 = 7

ENTER COMMAND >ASEL
8061 RECORD(S) SELECTED

ENTER COMMAND >LIST

1
AREA = -154,077,988.37665
PERIMETER = 81,156.43696
LCU89P8# = 1
LCU89P8-ID = 0
NWI_CODE =
LCU =
LCU-13 =
EPPL_CODE = 0
CLASS = 0
VEG_CODE = 0
PERCENT_CLOSURE =
TREE_HEIGHT =
CLASS7 = 0

2
AREA = 7,207.20691
PERIMETER = 589.31481
LCU89P8# = 2
LCU89P8-ID = 1
NWI_CODE = PFO1Ah
LCU = Acer
LCU-13 = Woody Terrestrial
EPPL_CODE = 76
MORE?
CLASS = 10
VEG_CODE = 1001
PERCENT_CLOSURE =>90
TREE_HEIGHT =>50
CLASS7 = 4

3
AREA = 5,512,459.62781
PERIMETER = 99,171.50744
LCU89P8# = 3
LCU89P8-ID = 2
NWI_CODE = L2UB3Hh
LCU = Water
LCU-13 = Open Water
EPPL_CODE = 14
CLASS = 1
VEG_CODE = 100
PERCENT_CLOSURE =
TREE_HEIGHT =
CLASS7 = 1

4
AREA = 10,283.37413
PERIMETER = 1,110.17646
LCU89P8# = 4
MORE?
LCU89P8-ID = 3
NWI_CODE = U
LCU = Rdside-levee/grass/forbs/shrub
LCU-13 = Grasses/Forbs
EPPL_CODE = 73
CLASS = 9
VEG_CODE = 916
PERCENT_CLOSURE =>90
TREE_HEIGHT =
CLASS7 = 3

5

AREA = 5,970,907.11059
PERIMETER = 27,367.48506
LCU89P8# = 5
LCU89P8-ID = 4
NWI_CODE =U
LCU =Urban
LCU-13 =Urban/Developed
EPPL_CODE = 92
CLASS = 12
VEG_CODE =1204
PERCENT_CLOSURE =
TREE_HEIGHT =
MORE?
CLASS7 = 6

Appendix B

AML Programs Used to Complete Project

The AML below was used to interactively draw the new coverage boundary in ARCEDIT, delete dangles, save the coverage, clip it with the land cover/use coverage, and display the results in ARCPLLOT.

```
/* AML used for the Upper Mississippi
/*River National Wildlife and Fish
/*Refuge extension project for
/*Jim Nissen
/* AML written by Lara Hill 3/17/94
/*/home/lrh0/refuge_ext/test.aml
/* to automate steps for refuge extension project
```

```
display 9999
ae
create clip farmluc
bc farmluc 4
be arcs
draw
ef arcs
de arcs
intersectarcs all
&type
&type Draw desired boundary
&type Be sure to connect all arcs
&type Middle button to start and end arcs
&type Left button for vertices
&type Cntrl and right button to quit
&type
add
save
sel dangle
delete
save
q
clean clip
clip farmluc clipluc
ap
mape clipluc
arcs clipluc
shadeset colornames
polygonshades clipluc symbol
&pause
q
&return
```

The AML below was used to write the area report for the newly created coverage. It is part of an existing AML (Olsen 1993).

The textfile below creates Figure B-1.

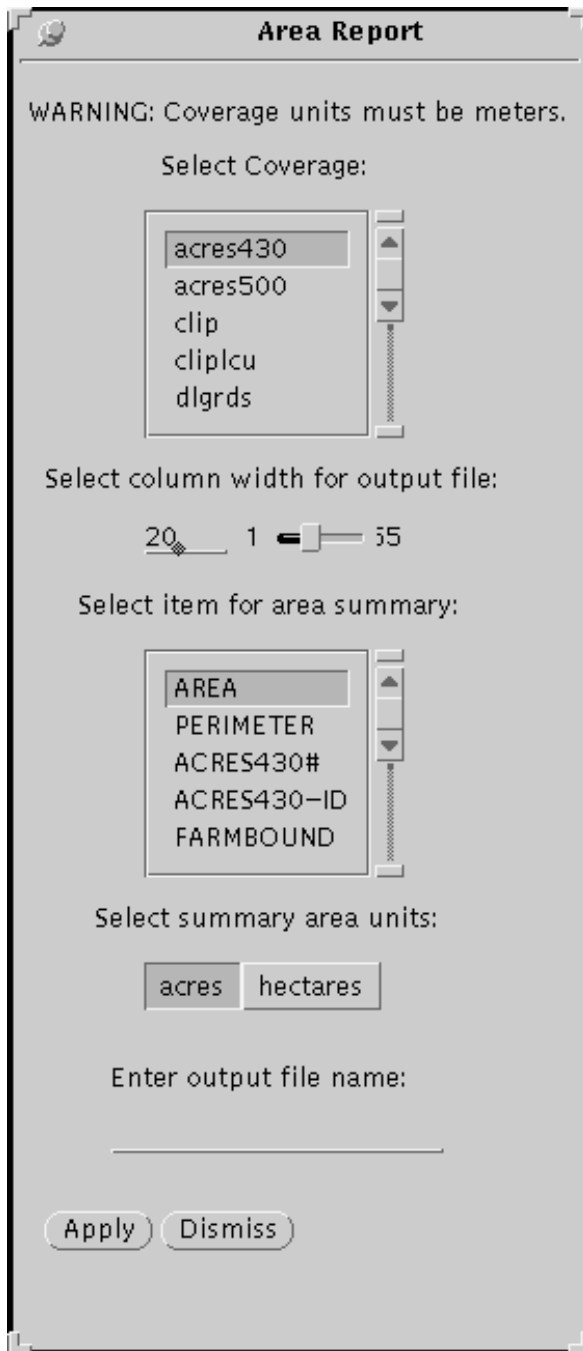


Figure B-1. Menu for area report routine of Production Arc

7 area.menu - front end for area.aml

WARNING: Coverage units must be meters.

Select Coverage:

% 1

Select column width for output file:

%2

Select item for area summary:

%3

Select summary area units:

%5

Enter output file name:

%4

%apply %dismiss

/*field definitions

%1 input .covername 16 scroll yes required cover * -poly ~
'Select a Coverage'

%2 slider .columnwidth 15 initial 20 integer 1 55

%3 input .sumitem 16 scroll yes required size 16 item % .covername% -poly

%4 input .outfilepath 20 initial " required size 20 character

%5 choice .sumunits single acres hectares

%apply button Apply &r area.aml; &thread &delete &self

%dismiss button cancel Dismiss &thread &delete &self

The program below takes the input from the area report menu (Fig. B-1) to produce the area report.

/* AREA.AML - outputs area.report for coverages with mapunits = meters
/* Written by Doug Olsen at EMTC as part of Production Arc AML

&set cover = % .covername%
&set coverpath = [dir %cover%]
&set cover = [after %cover% %coverpath%/
&set cover = [translate %cover%]
&s outfilepath = %coverpath%/% .outfilepath%

&set .sumunits = [translate % .sumunits%]

&sys rm %outfilepath%

frequency %cover%.pat %cover%.XXX
% .sumitem%

~

y

y

area

~

y

y

&data arc info
arc
SELECT %cover%.XXX
RESELECT AREA < 0

```

NSELECT
&if %sumunits% = HECTARES &then
  CALC AREA = AREA / 10000 /* go from sq. meters to hectares
&else
&do
  CALC AREA = AREA / 10000 /* go from sq. meters to hectares
  CALC AREA = AREA * 2.471 /* go from hectares to acres
&end

OUTPUT %outfilepath%
REPORT %cover%.RPX
%sumitem%
%columnwidth%
%sumitem%

FREQUENCY
T
FREQ.

AREA
T
%sumunits%

[quote %cover% AREA REPORT]
y
y
999

ERASE %cover%.RPX
Y
ERASE %cover%.XXX
y
Q STOP
&end

&type Area report complete.

&return

```

Appendix C

Farm, 430-, and 500-Acre Boundary Maps

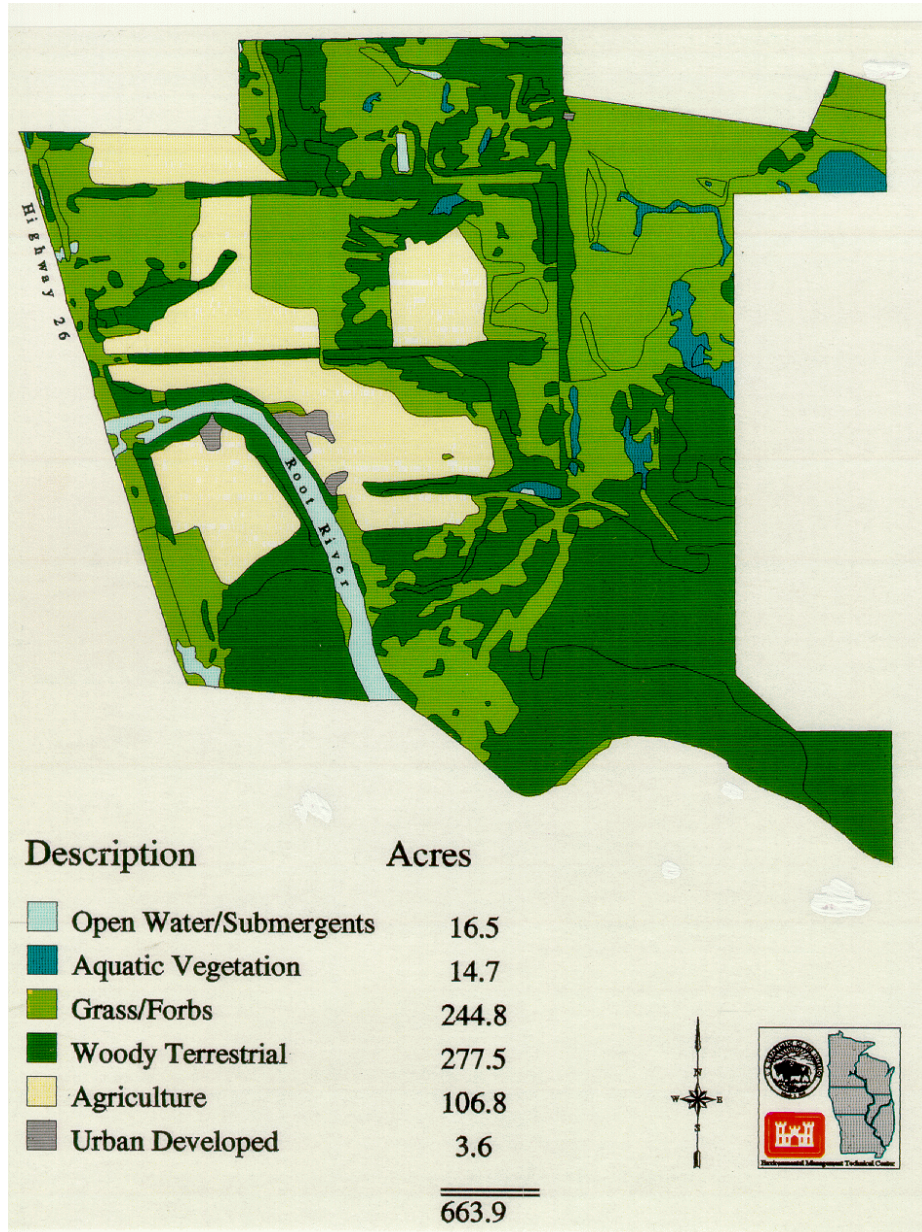


Figure C-1. La Crosse District land expansion proposal acreage report for the entire farm boundary.

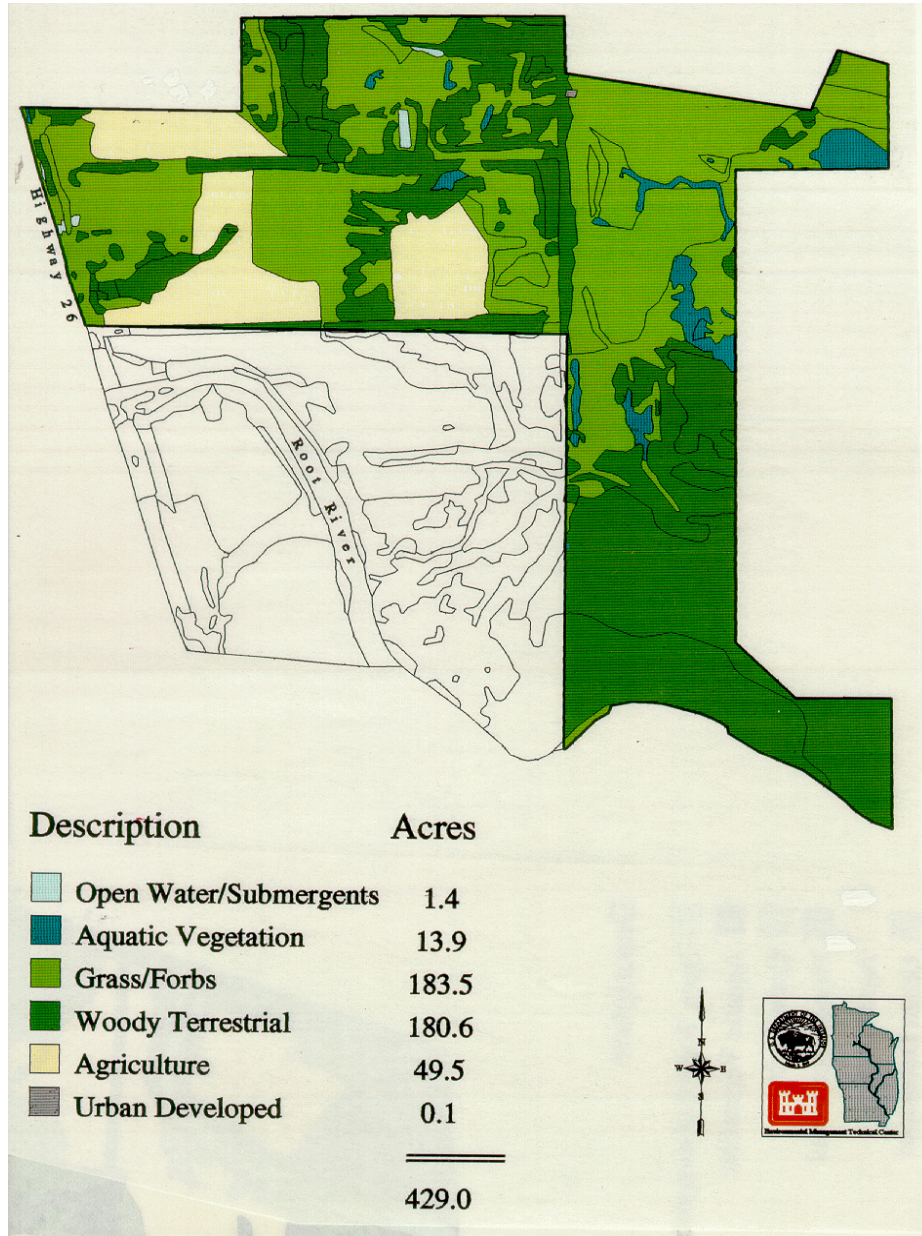


Figure C-2. Map and acreage report for 430-acre acquisition proposal.

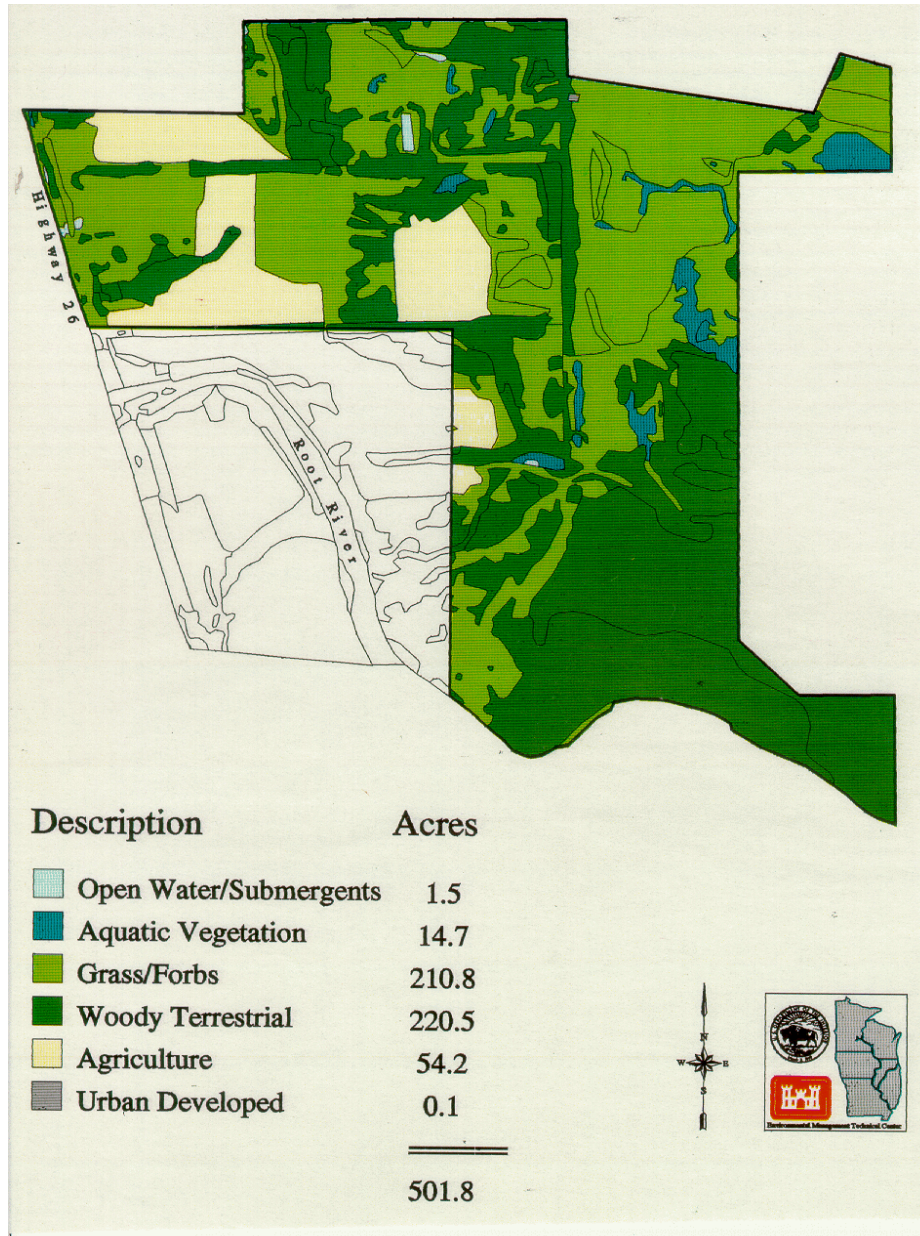


Figure C-3. Map and acreage report for 500-acre acquisition proposal.

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The Long Term Resource Monitoring Program (LTRMP) for the Upper Mississippi River System was authorized under the Water Resources Development Act of 1986 as an element of the Environmental Management Program. The mission of the LTRMP is to provide river managers with information to maintain the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character. The LTRMP is a cooperative effort by the National Biological Service, the U.S. Army Corps of Engineers, and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin.

