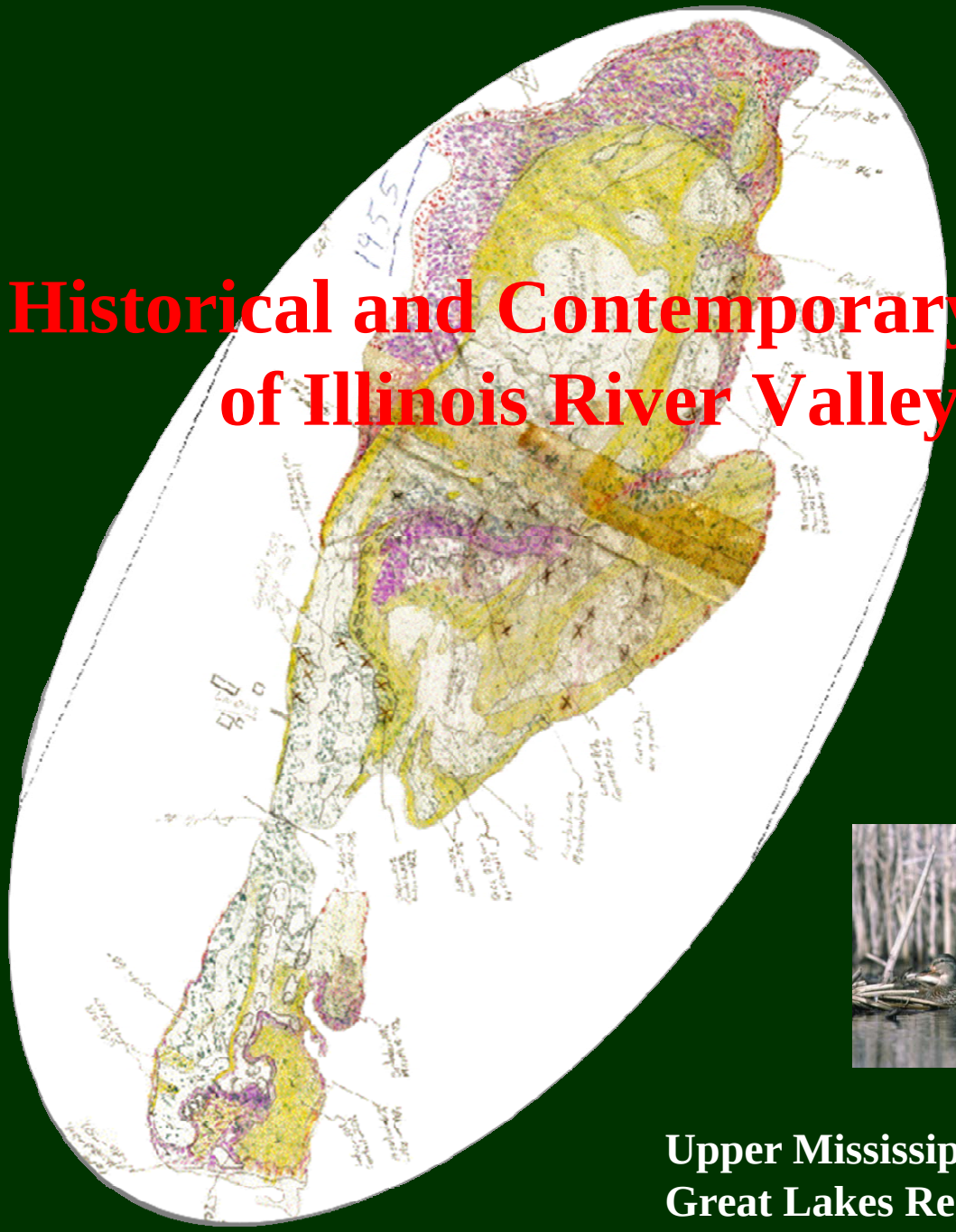
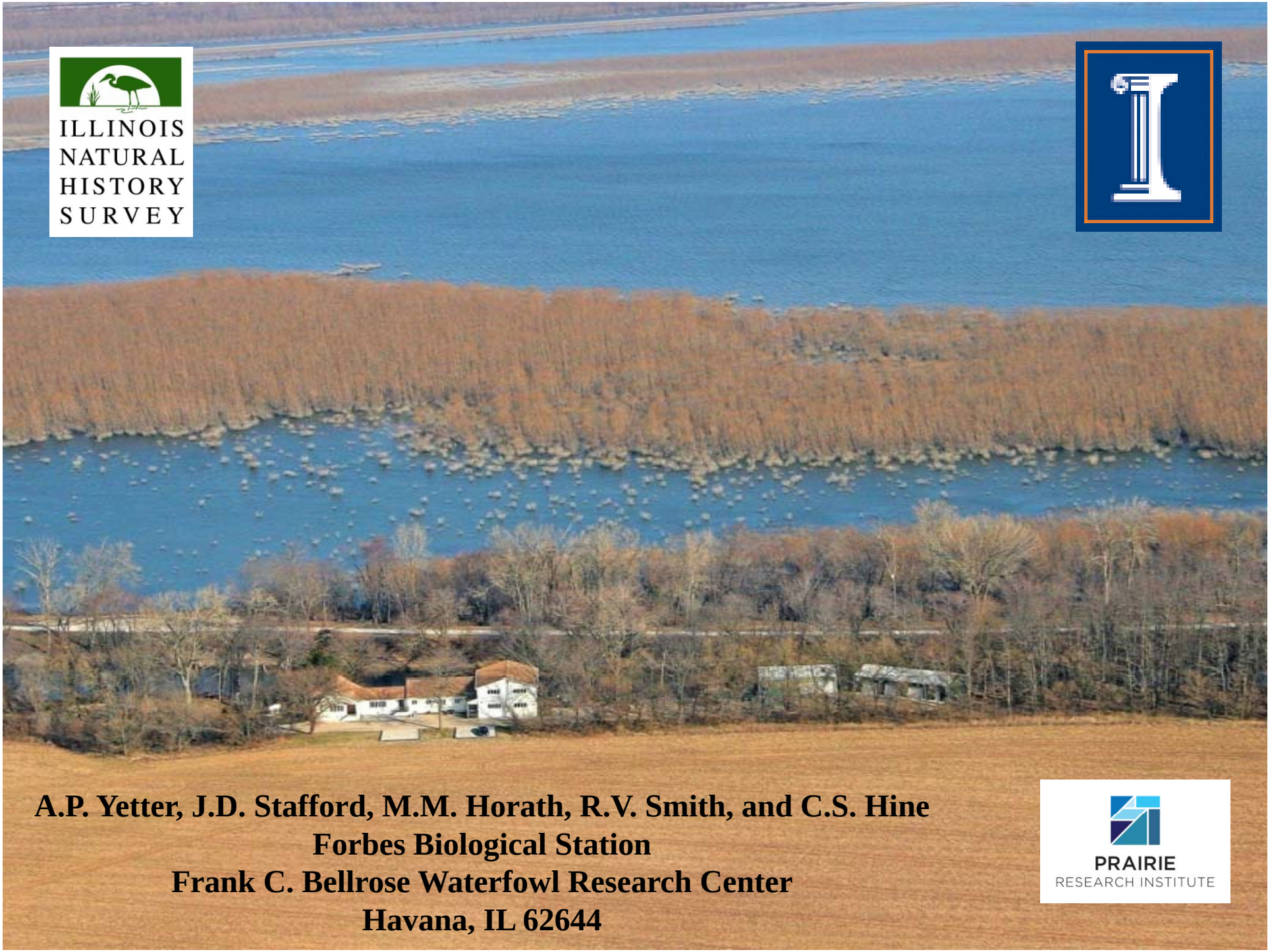
Historical and Contemporary Characteristics of Illinois River Valley Wetlands



Upper Mississippi River and
Great Lakes Region Joint Venture

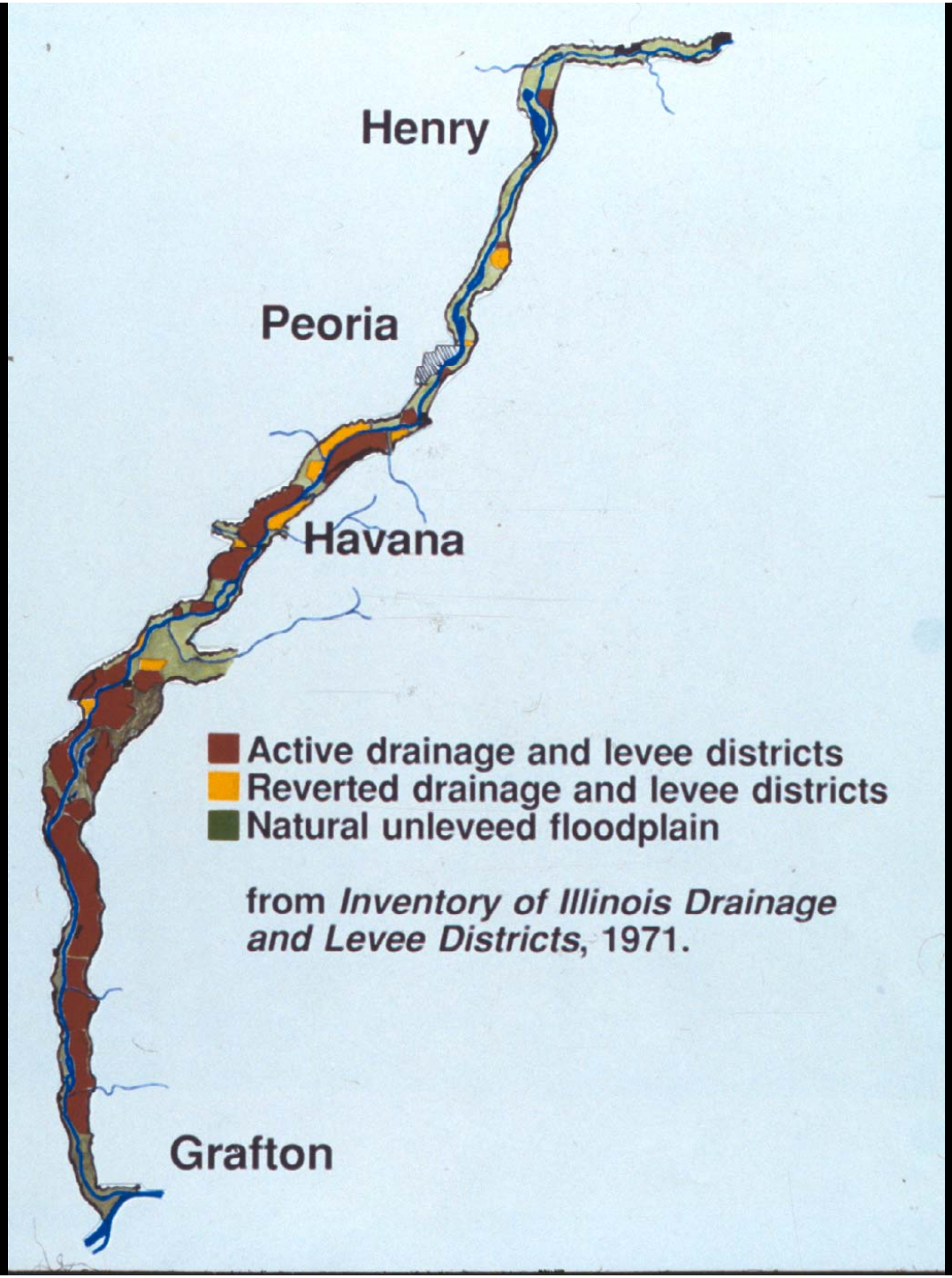


A.P. Yetter, J.D. Stafford, M.M. Horath, R.V. Smith, and C.S. Hine
Forbes Biological Station
Frank C. Bellrose Waterfowl Research Center
Havana, IL 62644


Why do we care about the Illinois River valley?
1.6 Million in IRV, 1948
21% Mississippi Flyway Mallards used IRV 1955-1996


>5% Global Pectoral Sandpipers
Migrate through IL annually.
Rice Lake, Anderson Lake, and
Chautauqua Lake noted as Important Bird Areas
and Western Hemisphere Shorebird Reserve Network site

Challenges


Henry
Peoria
Havana
Grafton
Active drainage and levee districts
Reverted drainage and levee districts
Natural unleveed floodplain
from *Inventory of Illinois Drainage and Levee Districts*, 1971.

~50% loss

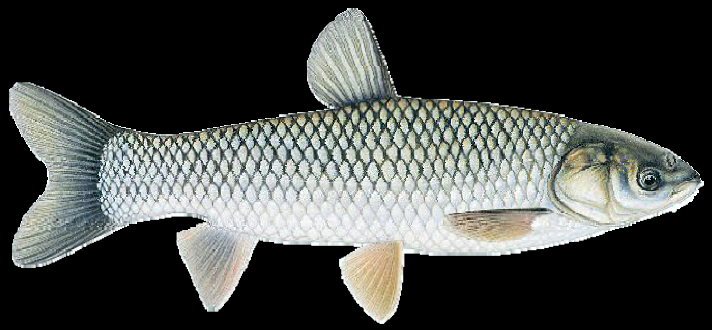
Muscooten Bay

near Beardstown

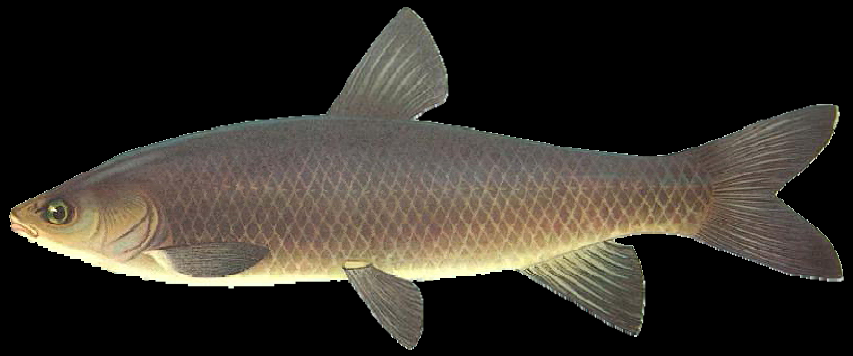
1933

1984

Asian Carp



Grass Carp, 1963



Black Carp, early 1970s

Bighead Carp, 1972

Common Carp, 1880s

Sliver Carp, 1973

Restoration is defined as:
a bringing back to a former position or condition.

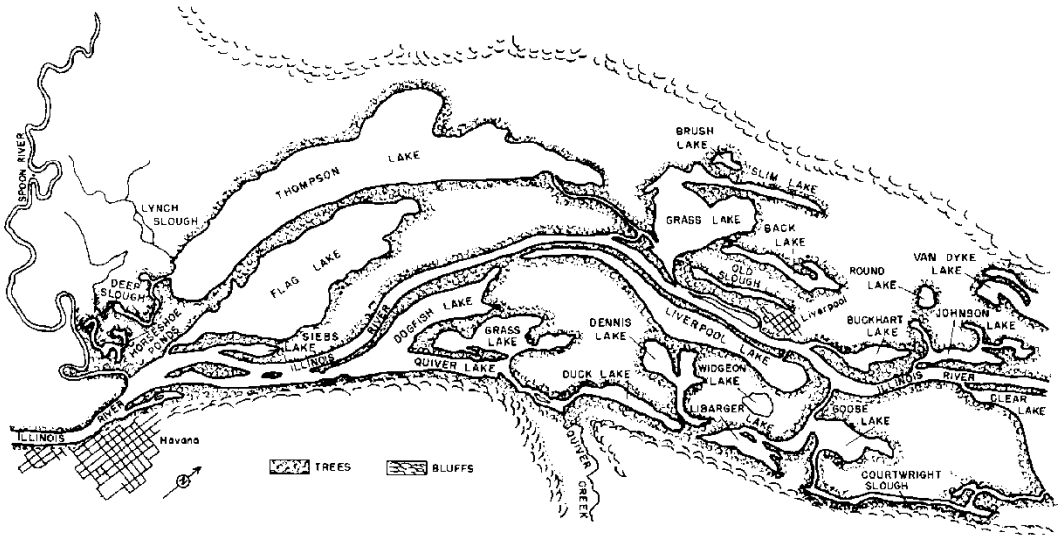
Merriam-Webster Online - www.merriam-webster.com

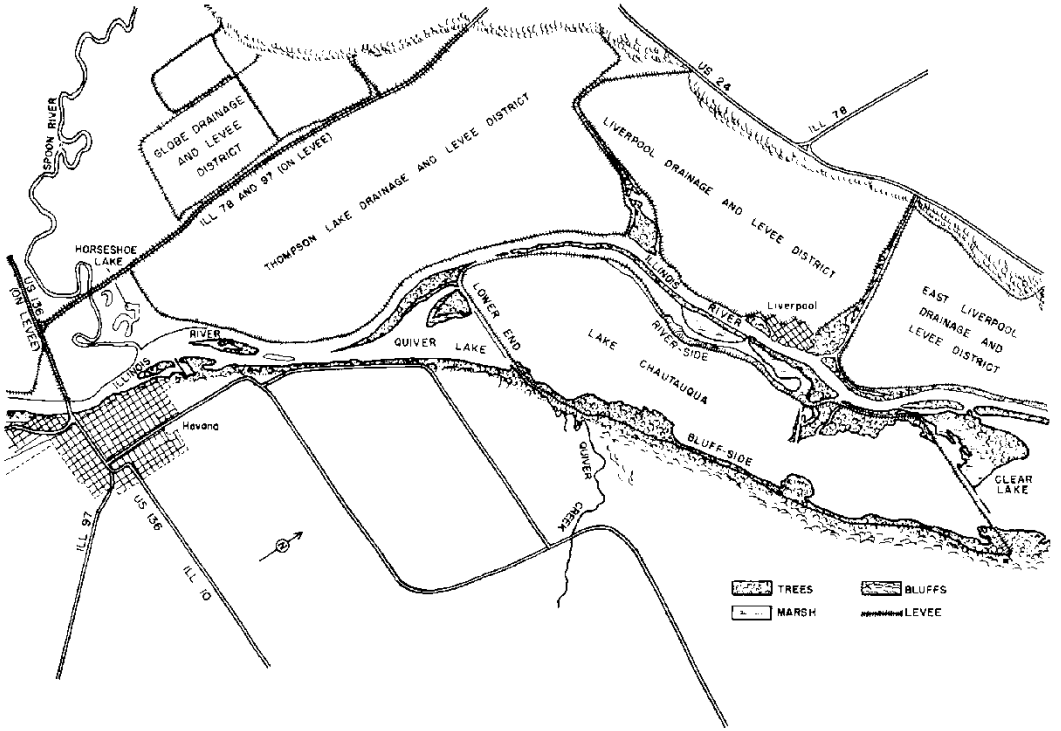
The goal of ecological restoration has been defined as: "The return of an ecosystem to a close approximation of its condition prior to disturbance." (National Research Council 1992).

Navigation and Ecosystem Sustainability Program (NESP)

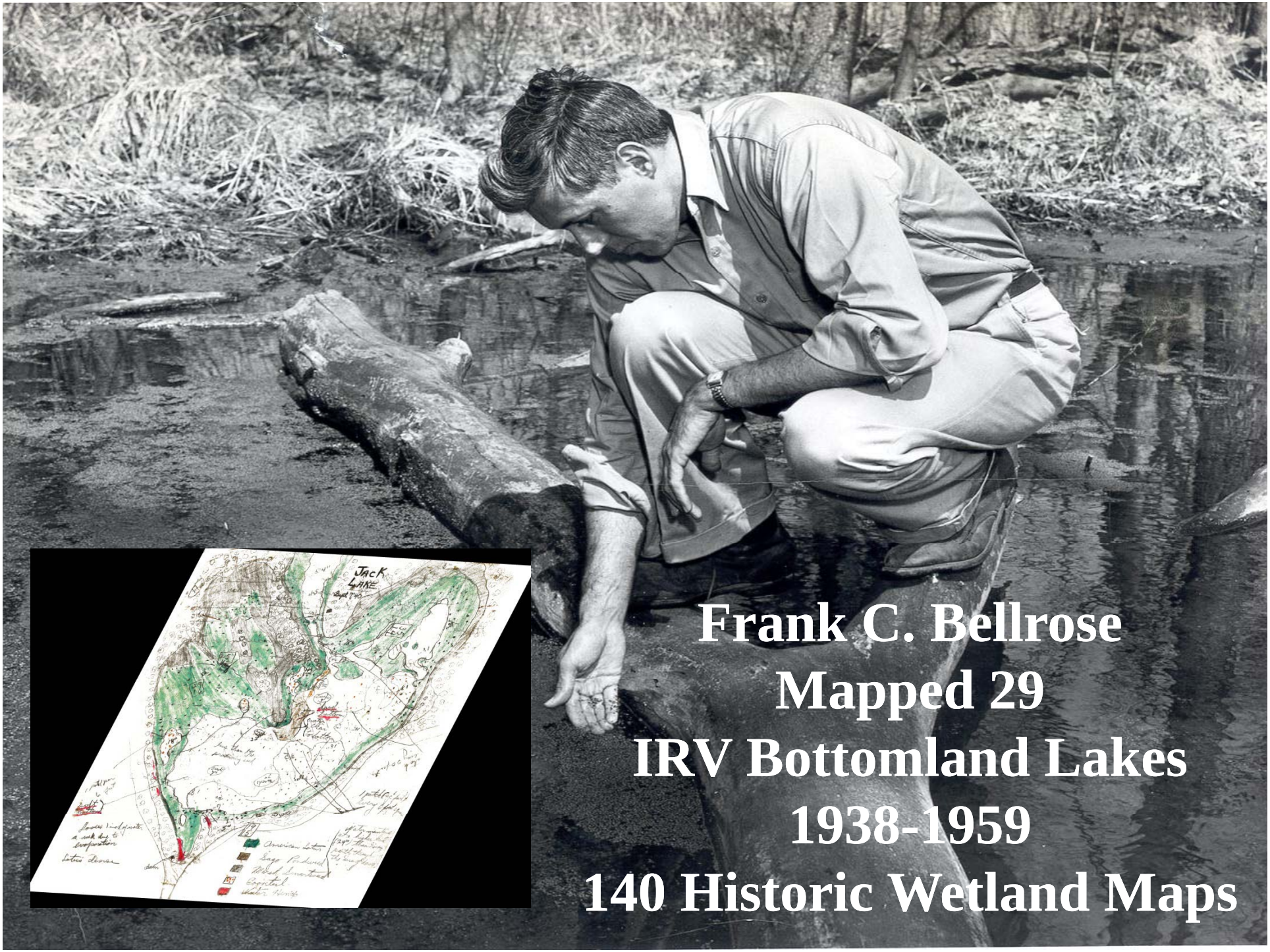
Illinois River Basin Restoration Plan

$7.95 Billion over 50 yr


SPOON RIVER
LYNCH SLOUGH
THOMPSON LAKE
FLAG LAKE
DEER SLOUGH
HORSESHOE LAKE
SIEBS LAKE
DOGFISH LAKE
GRASS LAKE
DENNIS LAKE
QUIVER LAKE
DUCK LAKE
BRUSH LAKE
SLIM LAKE
GRASS LAKE
BACK LAKE
OLD SLOUGH
ROUND LAKE
VAN DYKE LAKE
LIVERPOOL LAKE
BUCKHART LAKE
JOHNSON LAKE
WIDGEON LAKE
LIBARGER LAKE
GOOSE LAKE
CLEAR LAKE
ILLINOIS RIVER
COURTWRIGHT SLOUGH
QUIVER CREEK
Havana
TREES
BLUFFS


SPOON RIVER
GLOBE DRAINAGE AND LEVEE DISTRICT
ILL 78 AND 97 (ON LEVEE)
THOMPSON LAKE DRAINAGE AND LEVEE DISTRICT
LIVERPOOL DRAINAGE AND LEVEE DISTRICT
US 24
ILL 78
HORSESHOE LAKE
US 136 (ON LEVEE)
ILLINOIS RIVER
QUIVER LAKE
LOWER END
LAKE CHAUTAUQUA
RIVER-SIDE
BLUFF-SIDE
Liverpool
EAST LIVERPOOL DRAINAGE AND LEVEE DISTRICT
CLEAR LAKE
Havana
QUIVER CREEK
ILL 97
US 136
ILL 10
TREES
BLUFFS
MARSH
LEVEE

Rice Lake, 1950



Frank C. Bellrose
Mapped 29
IRV Bottomland Lakes
1938-1959
140 Historic Wetland Maps

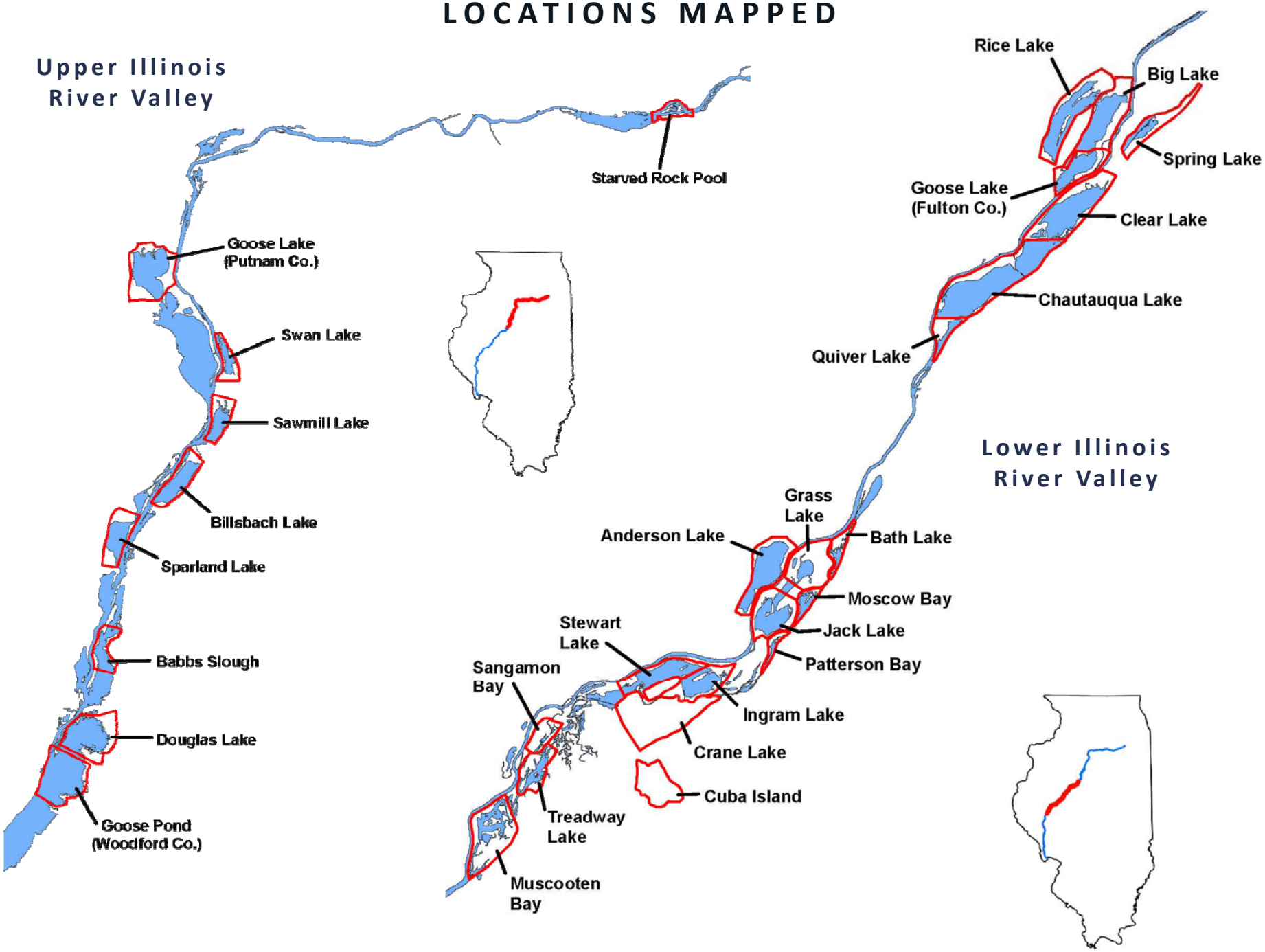
Bellrose Waterfowl Research Center
Remapped 15 wetlands
2005-2006

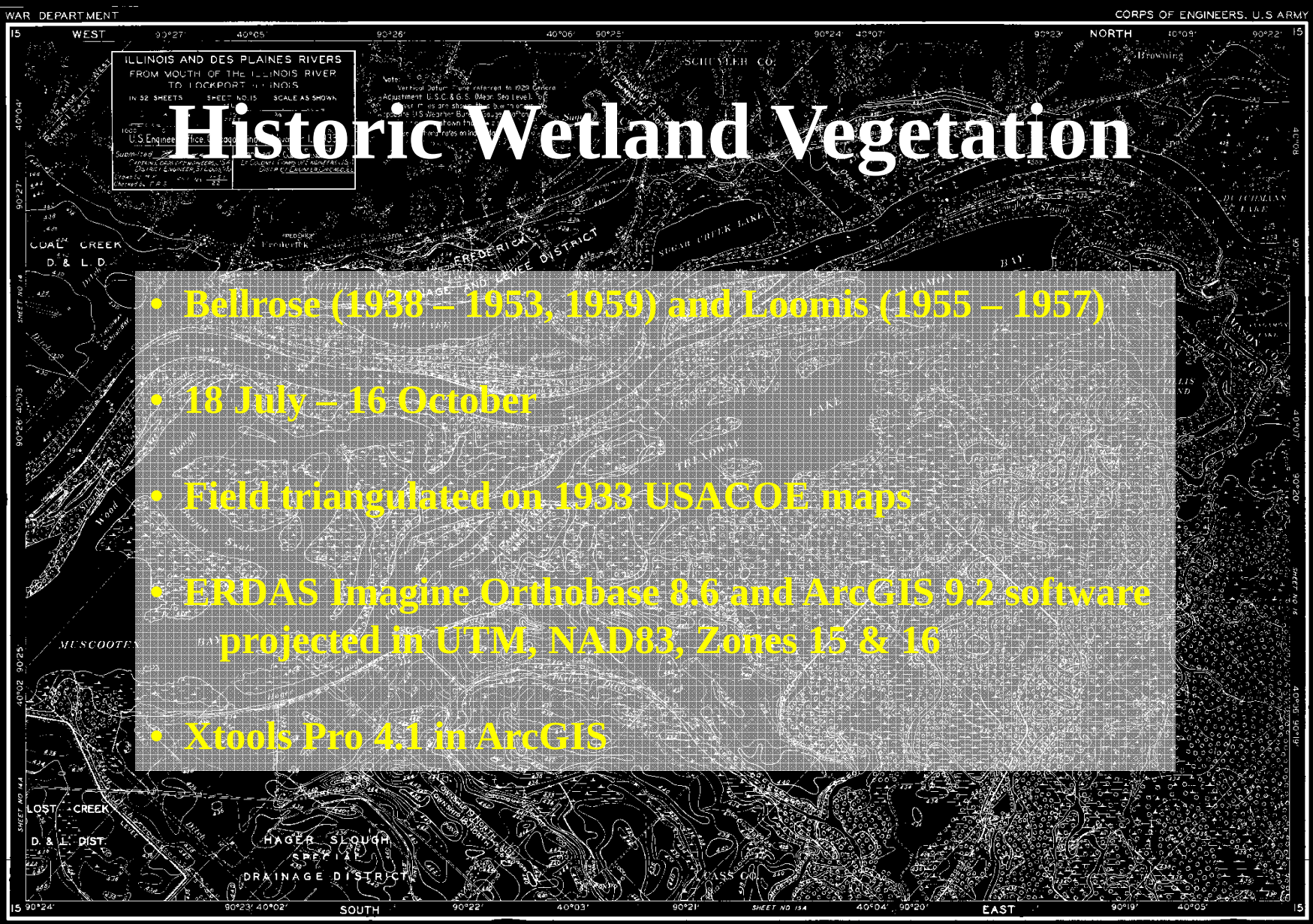
Objectives

- **Evaluate changes in wetland characteristics of selected IRV wetlands among historical and contemporary periods.**

- **Model use of IRV wetlands by mallards and lesser scaup in relation to historic and contemporary wetland characteristics.**

LOCATIONS MAPPED





Historic Wetland Vegetation

- Bellrose (1938 – 1953, 1959) and Loomis (1955 – 1957)
- 18 July – 16 October
- Field triangulated on 1933 USACOE maps
- ERDAS Imagine Orthobase 8.6 and ArcGIS 9.2 software projected in UTM, NAD83, Zones 15 & 16
- Xtools Pro 4.1 in ArcGIS

- **Mapped wetlands August-September**
- **300m transects (N/S or E/W)**
- **Handheld GPS & field notes, photos**
- **Digitized habitat features on 2005-2006 aerials**
- **USDA Geospatial Data Gateway**
  http://datagateway.nrcs.usda.gov/
- **ArcGIS 9.2 and Xtools Pro 4.1 ext.**
- **MANOVA**


Early Historic (1938 – 1942)
Late Historic (1943 – 1959)
Contemporary (2005 – 2006)
Flood of record was spring 1943

Wetland Habitat Classification

Bottomland forest – woody plants > 6m in height
Scrub-shrub – woody plants ≤ 6m in height
Non-persistent emergent – moist-soil vegetation (annual grasses)
Persistent emergent – robust vegetation (perennials; cattail)
Aquatic bed – submersed aquatic vegetation
Floating-leaved aquatic – vegetation on or above the water surface
Mud flat – lacking water or vegetation
Open water – open water without vegetation

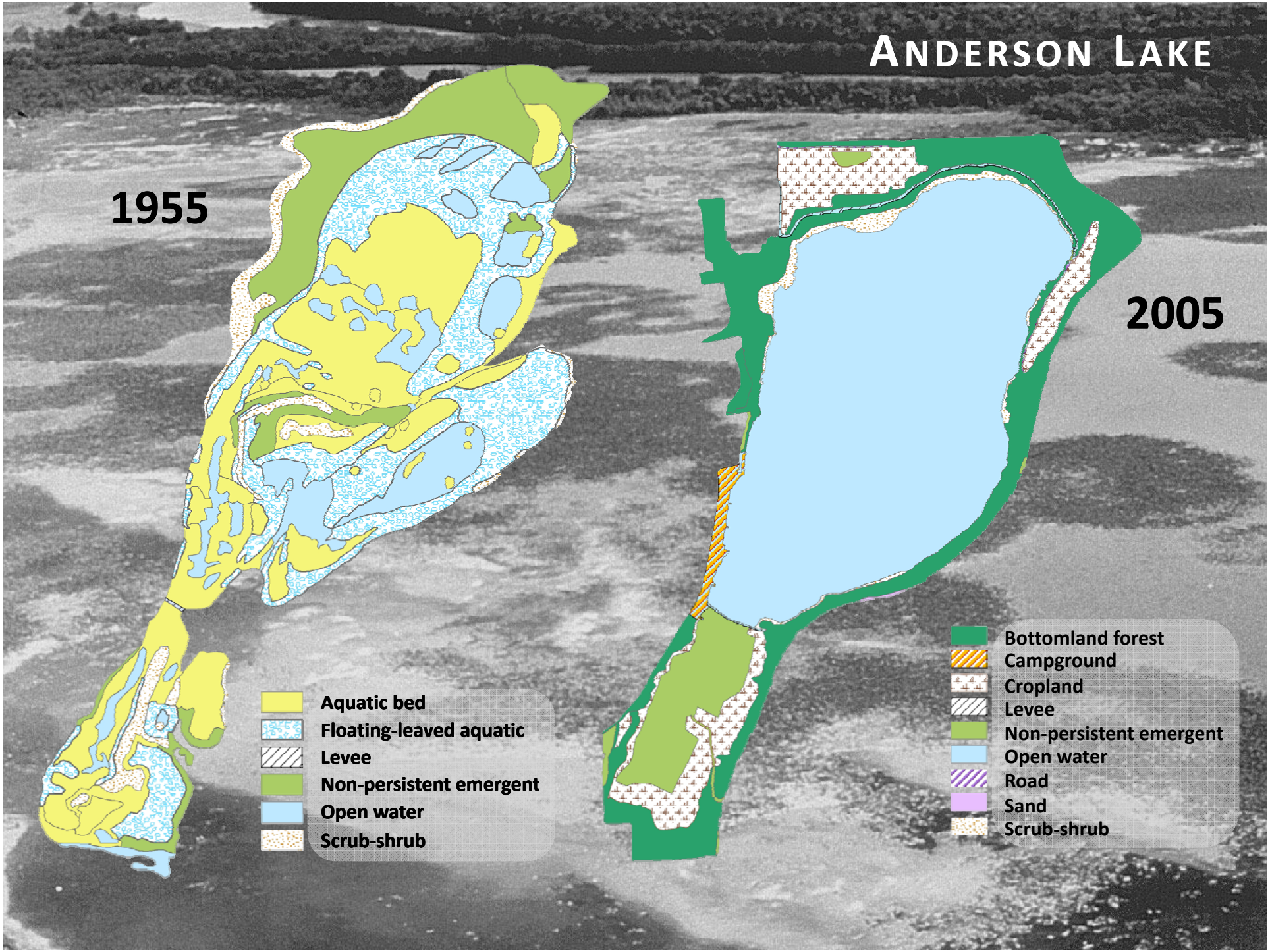
Interspersion-juxtaposition index – measure of heterogeneity
Relative richness – proportion of habitat categories present

INHS Aerial Inventories

- **Fall - since 1948-2010**
- **Mallard and Scaup use-days**
  - **(1 Oct. – 15 Dec.)**
- **1950-1959; 2005-2006**
- **Modeled UDs in relation to habitat classes, IJI, RR, wetland area, and refuge (25% category)**

Fall Use-Day Analysis

- **100 ducks for 10 days would be 1,000 UDs**
- **Maximum likelihood estimation in Proc Mixed**
- **Accounted for correlation in UDs among sites over time by including WETLAND nested in YEAR in a REPEATED statement.**
- **Best approximating/competing models using 2nd order AIC**

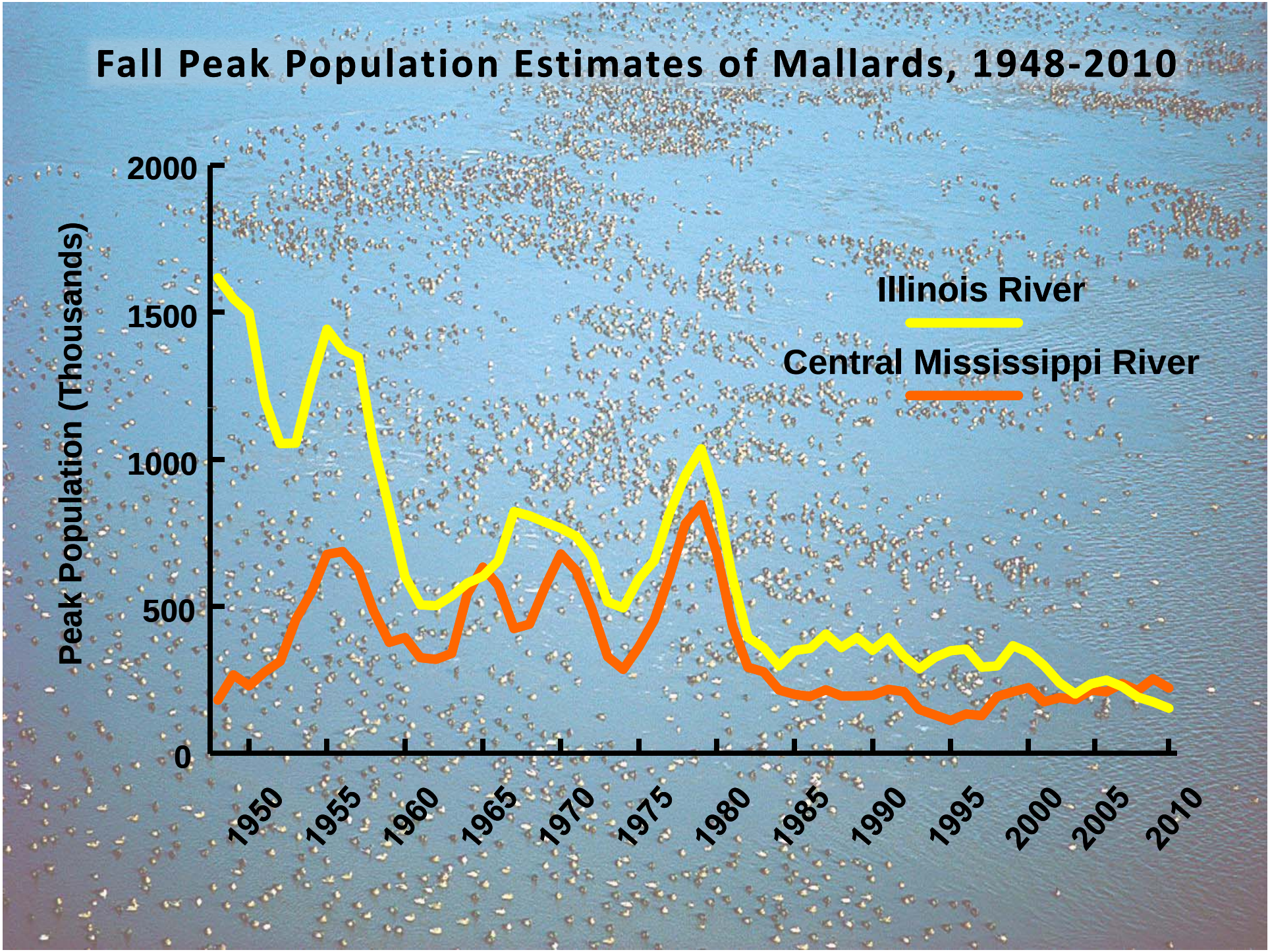

ANDERSON LAKE
1955
2005
Aquatic bed
Floating-leaved aquatic
Levee
Non-persistent emergent
Open water
Scrub-shrub
Bottomland forest
Campground
Cropland
Levee
Non-persistent emergent
Open water
Road
Sand
Scrub-shrub

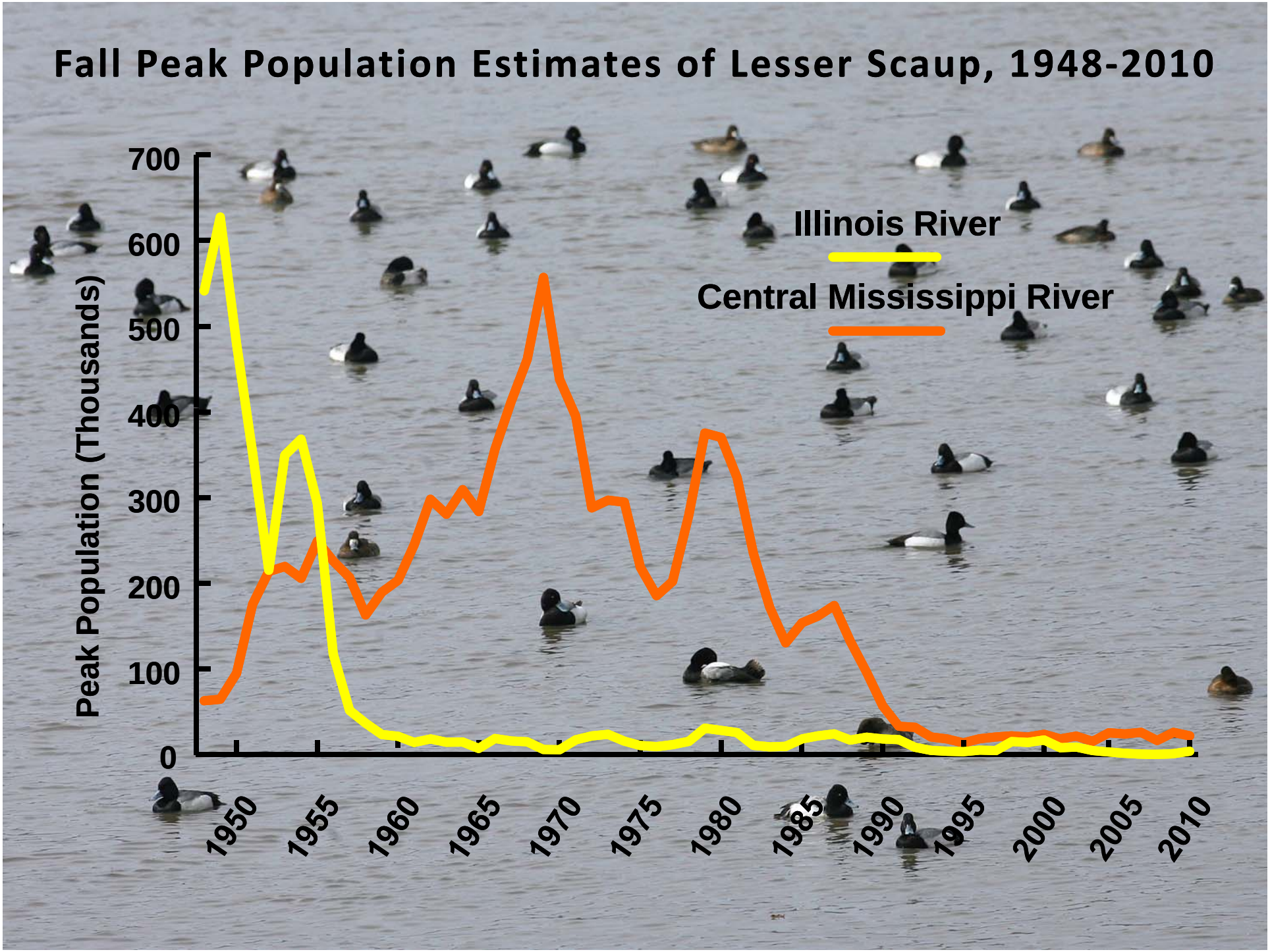
Illinois River Valley

Wetland Habitat Composition (%)
Early historic, Late historic, Contemporary

	Time Period		
Habitat type	**1938-1942**	**1943-1959**	**2005-2006**
Bottomland forest	8.8 A	8.2 A	15.3 B
Non-persistent emergent	12.4 A	21.3 B	32.5 B
Open water	38.7 A	41.7 A	37.6 A
Aquatic bed	11.2 A	14.1 A	<0.1 B
Floating-leaved	14.9 A	7.2 A	<0.1 B
Mud flat	0.4 A	0.1 A	1.7 B
Persistent emergent	12.3 A	5.3 B	3.9 B
Scrub-shrub	1.3 A	2.2 A	5.2 B
Interspersion index (IJI)	69.6 A	63.7 B	65.8 AB

MANOVA; Wilks' $\lambda = 0.38$; $F_{20,182} = 5.65$; $P < 0.001$; Tukey-Kramer post hoc $P \leq 0.01$


Fall Peak Population Estimates of Mallards, 1948-2010
Peak Population (Thousands)
2000
1500
1000
500
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Illinois River
Central Mississippi River


Fall Peak Population Estimates of Lesser Scaup, 1948-2010
Peak Population (Thousands)
700
600
500
400
300
200
100
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Illinois River
Central Mississippi River

Mallard Use-Days

Fall 1950-1959

- **2 models accounted for 80.4% model weight**
- **Positively associated with:**
  - **Area**
  - **Refuge**
  - **Interspersion-juxtaposition index**
  - **Non-persistent emergent**
- **Negatively associated with:**
  - **Persistent emergent**

Mallard Use-Days

Fall 2005-2006

- **Best model accounted for 97.3% model weight**

- **Positively associated with:**
  - **Area**
  - **Refuge**

None of the other models were competitive

Lesser Scaup Use-Days

Fall 1950-1959

- **3 models accounted for 59.5 % model weight**

- **Positively associated with:**
  - **Area**
  - **Refuge**
  - **Non-persistent emergent**

- **Negatively associated with:**
  - **Persistent emergent**
  - **Scrub-shrub**

Summary

Illinois River valley wetlands have become homogenous:

- **Non-persistent emergent vegetation increased**
- **AB and FLOAT virtually absent in 2005-2006**

Mallard abundance declined over time:

- **Refuge: UDs increased 24.8% of each categorical increase in Refuge**
- **NPE: UDs increased 8.7% for each 5% increase in NPE**
- **IJI: UDs correlated with IJI; mallards used diverse habitats**

Conservation planners consider composition and arrangement of wetland habitats once energetic goals are met

Wetlands (2010) 30:565–576
DOI 10.1007/s13157-010-0049-3

ORIGINAL PAPER

Historical and Contemporary Characteristics and Waterfowl Use of Illinois River Valley Wetlands

Joshua D. Stafford · Michelle M. Horath · Aaron P. Yetter · Randolph V. Smith · Christopher S. Hine

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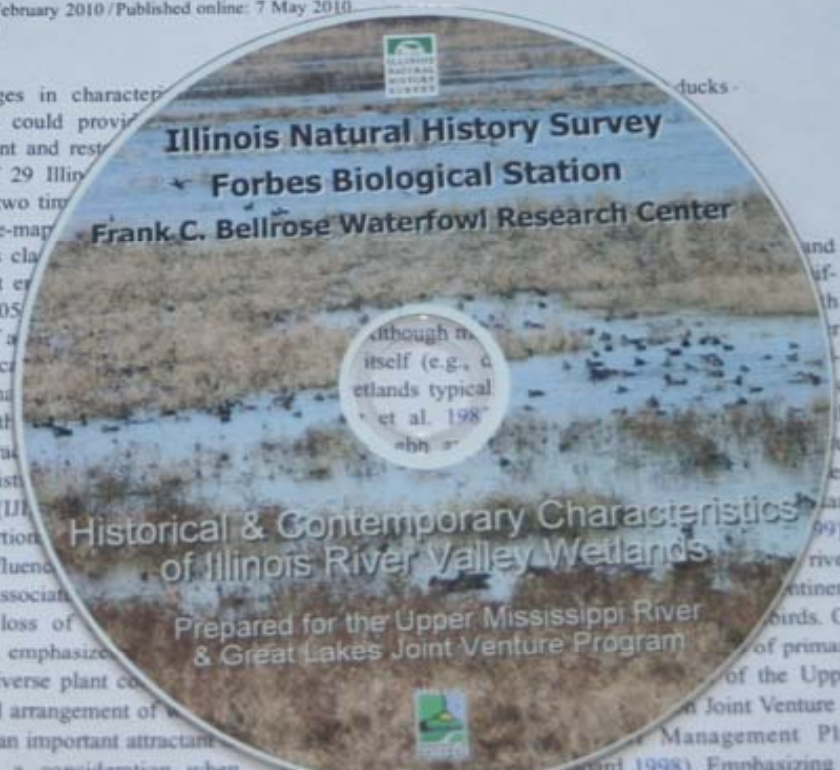
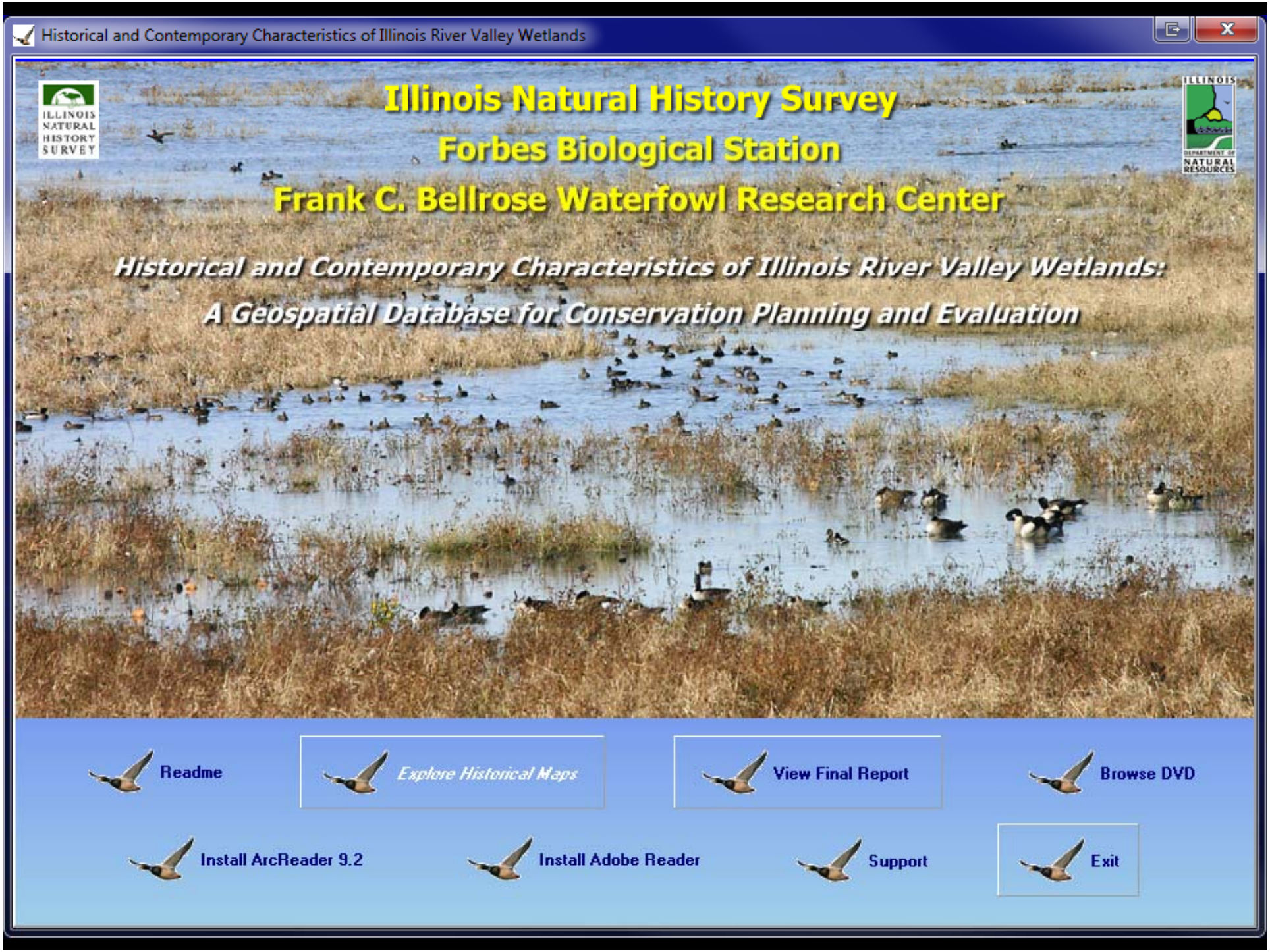


Abstract Understanding changes in character… ducks … floodplain wetlands over time could provi… information to guide management and rest… We compared characteristics of 29 Illin… (IRV) wetlands mapped during two tim… 1938–1959 and 15 wetlands re-map… Average proportions of wetlands cla… forest, scrub-shrub, nonpersistent em… were generally greater during 2005… or 1943–1959, but proportions of a… leaved vegetation declined significa… also modeled wetland use by ma… *chos*) and diving ducks (Tribe Ayth… 1959 in relation to wetland chara… wetlands classified as nonpersist… interspersion-juxtaposition index (IJI… with mallard use, whereas proportion… persistent emergent vegetation influen… negatively. Use by both groups associat… wetland area and refuge. The loss of… floating-leaved aquatic vegetation emphasize… restore conditions that promote diverse plant co… in IRV wetlands. Composition and arrangement of … habitats (indicated by IJI) may be an important attractant … migrating mallards and perhaps a consideration when planning and evaluating wetland conservation efforts in mid-migration regions.

…although n… itself (e.g., … etlands typical … et al. 198… …hh …

…and …f- …h …r …l …e …er …an …99). …river …ntinent …birds. Of …of primary …of the Upper …n Joint Venture of … Management Plan …oard 1998). Emphasizing its historical importance to waterfowl, 1.6 million mallards (*Anas platyrhynchos*) were counted during one aerial


Historical and Contemporary Characteristics of Illinois River Valley Wetlands
ILLINOIS NATURAL HISTORY SURVEY
Illinois Natural History Survey
Forbes Biological Station
Frank C. Bellrose Waterfowl Research Center
Historical and Contemporary Characteristics of Illinois River Valley Wetlands:
A Geospatial Database for Conservation Planning and Evaluation
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
Readme
Explore Historical Maps
View Final Report
Browse DVD
Install ArcReader 9.2
Install Adobe Reader
Support
Exit

Explore Maps - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Explore Maps

file:///F:/Explore maps.htm

Web Search

Illinois Natural History Survey

Forbes Biological Station

F. C. Bellrose Waterfowl Research Center

From this page you can explore the historical and contemporary maps we published in ArcMap 9.2 using the free, desktop mapping application, ArcReader 9.2. If you are an ArcGIS 9.2 user, then the correct version of ArcReader will already be on your computer since it is included with ArcGIS Desktop. If ArcReader is not installed on your computer or you need the 9.2 version you can click here to install.

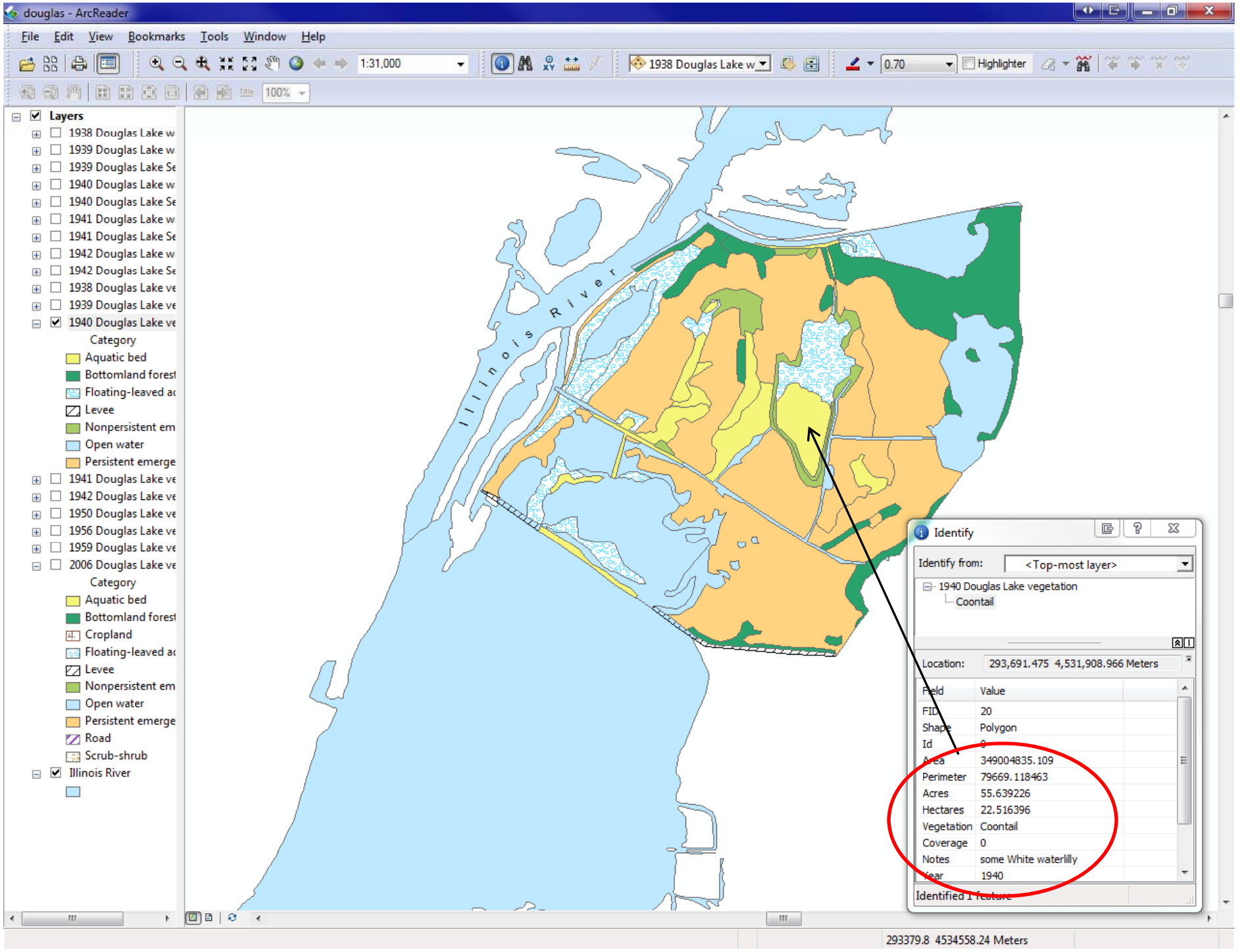
The maps are grouped by location so all map layers (vegetation, water depth [inches], and Secchi depth [inches]) for all years are packaged in individual ArcReader (.pmf) files. You can access maps for a particular location by either clicking the location name in the table below or using these location maps that are divided into two river regions:

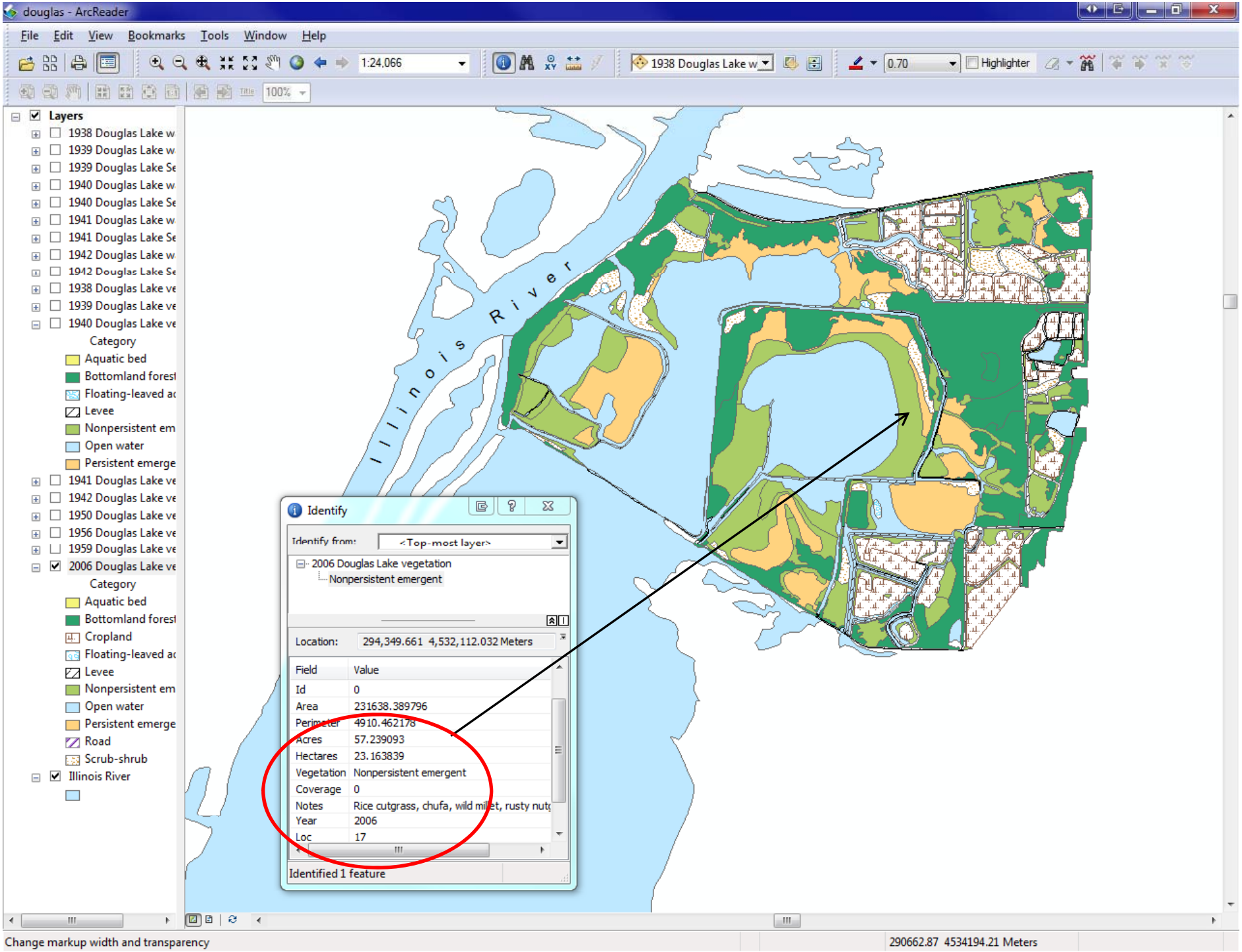
Upper Illinois River and Lower Illinois River.

Anderson Lake	Clear Lake	Goose Lake (Woodford)	Patterson Bay	Spring Lake
Babbs Slough	Crane Lake	Grass Lake	Quiver Lake	Starved Rock Pool
Bath Lake	Cuba Island	Ingram Lake	Rice Lake	Stewart Lake
Big Lake	Douglas Lake	Jack Lake	Sangamon Bay	Swan Lake (Putnam)
Billsbach Lake	Goose Lake (Fulton)	Moscow Bay	Sawmill Lake	Treadway Lake
Chautauqua Lake	Goose Lake (Putnam)	Muscooten Bay	Sparland Lake	

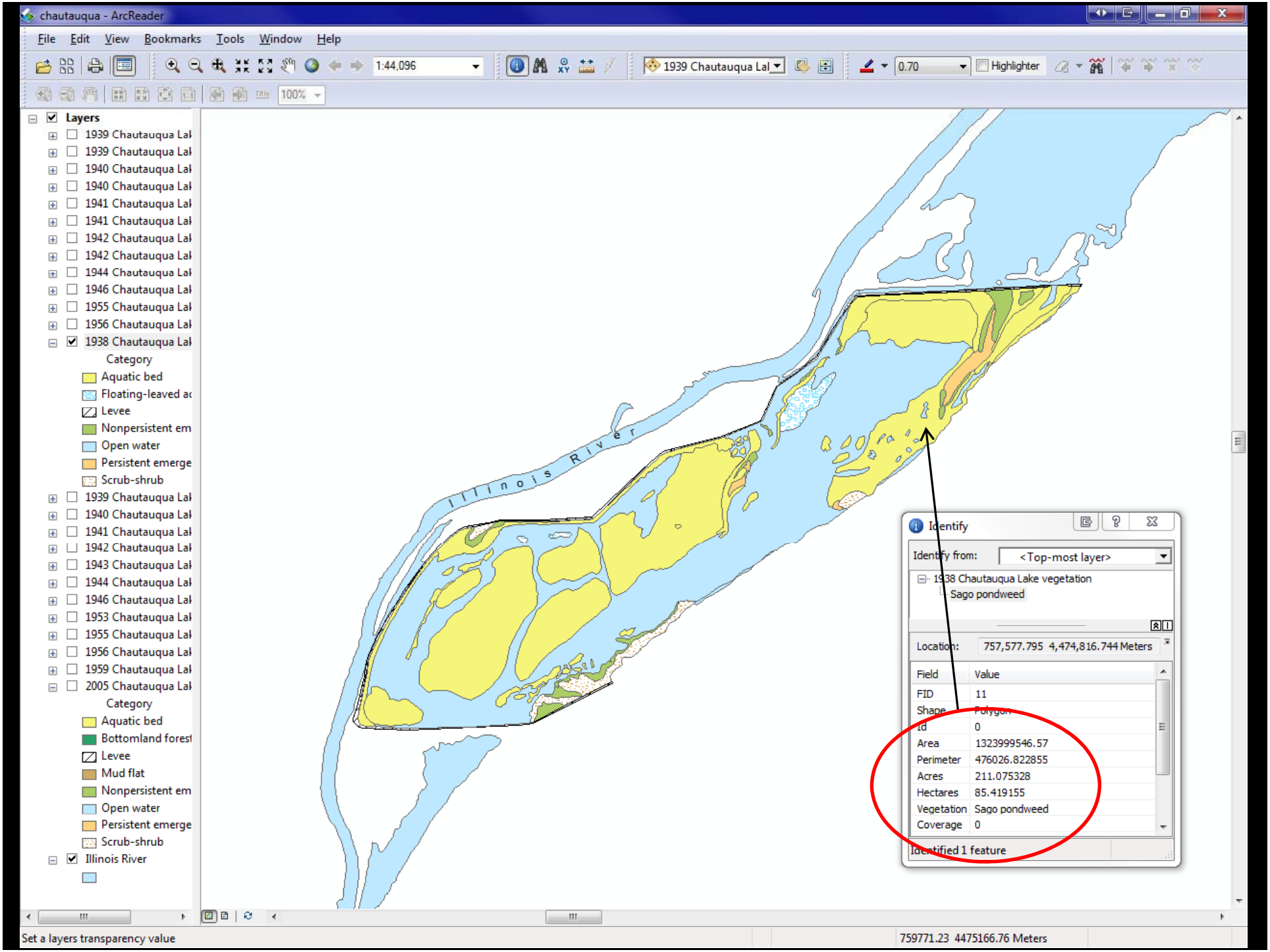
For experienced ArcGIS users, you may also view the map data by either accessing the shapefiles in the /Shapefiles folder or open the ArcMap documents (.mxd) stored in the /Map Documents folder using ArcGIS 9.2. The ArcMap map documents (.mxd) have the shapefiles for all layers (vegetation, water depth [inches], and Secchi depth [inches]) and all years grouped by location.

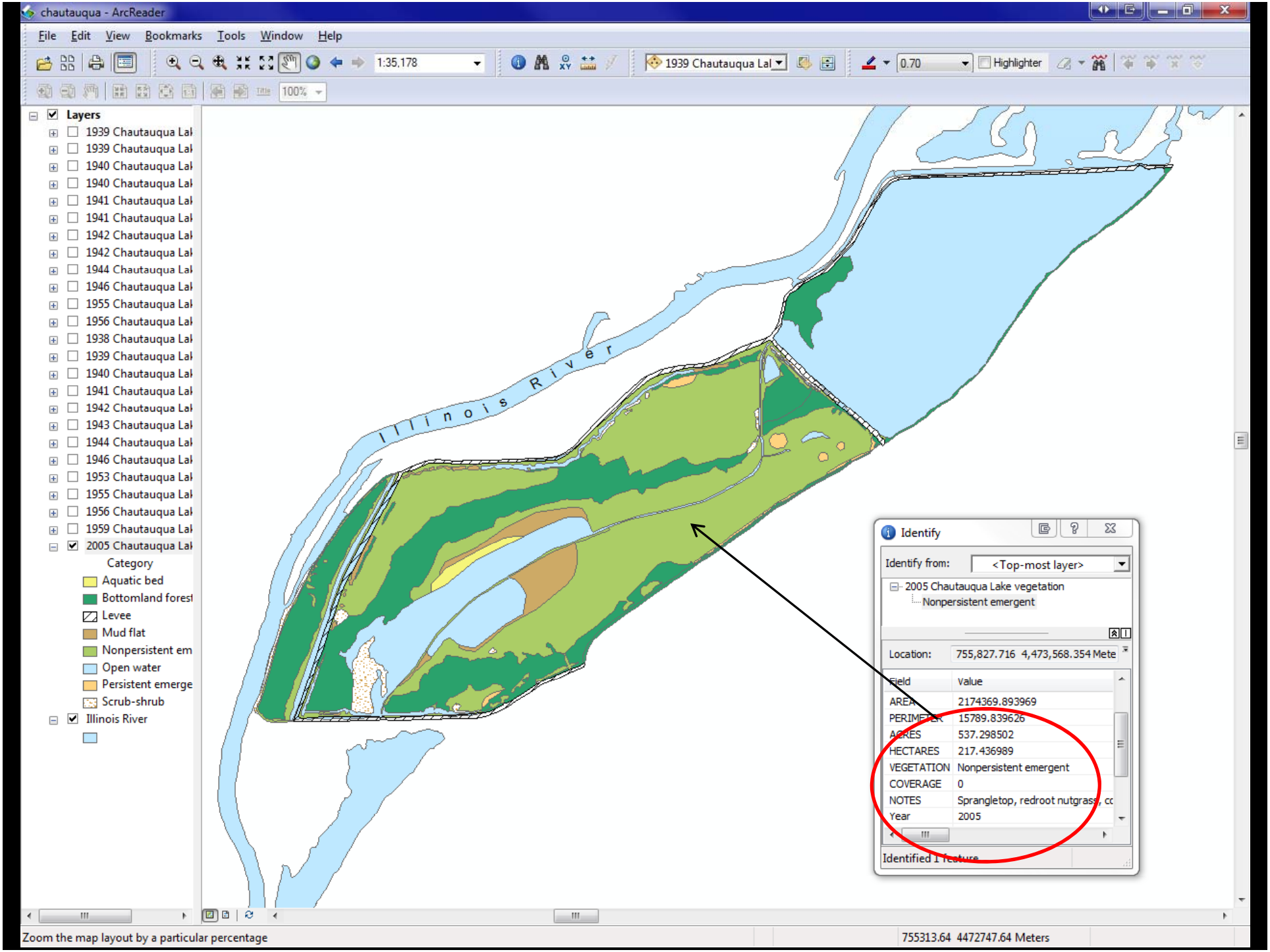
Douglas Lake


douglas - ArcReader
File Edit View Bookmarks Tools Window Help
1:31,000
1938 Douglas Lake w
0.70
Highlighter
100%
Layers
1938 Douglas Lake w
1939 Douglas Lake w
1939 Douglas Lake Se
1940 Douglas Lake w
1940 Douglas Lake Se
1941 Douglas Lake w
1941 Douglas Lake Se
1942 Douglas Lake w
1942 Douglas Lake Se
1938 Douglas Lake ve
1939 Douglas Lake ve
1940 Douglas Lake ve
Category
Aquatic bed
Bottomland forest
Floating-leaved ac
Levee
Nonpersistent em
Open water
Persistent emerge
1941 Douglas Lake ve
1942 Douglas Lake ve
1950 Douglas Lake ve
1956 Douglas Lake ve
1959 Douglas Lake ve
2006 Douglas Lake ve
Category
Aquatic bed
Bottomland forest
Cropland
Floating-leaved ac
Levee
Nonpersistent em
Open water
Persistent emerge
Road
Scrub-shrub
Illinois River
Illinois River
Identify
Identify from:
<Top-most layer>
1940 Douglas Lake vegetation
Coontail
Location:
293,691.475 4,531,908.966 Meters
Field
Value
FID
20
Shape
Polygon
Id
0
Area
349004835.109
Perimeter
79669.118463
Acres
55.639226
Hectares
22.516396
Vegetation
Coontail
Coverage
0
Notes
some White waterlilly
Year
1940
Identified 1 feature
293379.8 4534558.24 Meters


douglas - ArcReader
File Edit View Bookmarks Tools Window Help
1:24,066
1938 Douglas Lake w
0.70
Highlighter
100%
Layers
1938 Douglas Lake w
1939 Douglas Lake w
1939 Douglas Lake Se
1940 Douglas Lake w
1940 Douglas Lake Se
1941 Douglas Lake w
1941 Douglas Lake Se
1942 Douglas Lake w
1938 Douglas Lake ve
1939 Douglas Lake ve
1940 Douglas Lake ve
Category
Aquatic bed
Bottomland forest
Floating-leaved ac
Levee
Nonpersistent em
Open water
Persistent emerge
1941 Douglas Lake ve
1942 Douglas Lake ve
1950 Douglas Lake ve
1956 Douglas Lake ve
1959 Douglas Lake ve
2006 Douglas Lake ve
Category
Aquatic bed
Bottomland forest
Cropland
Floating-leaved ac
Levee
Nonpersistent em
Open water
Persistent emerge
Road
Scrub-shrub
Illinois River
Illinois River
Identify
Identify from:
<Top-most layer>
2006 Douglas Lake vegetation
Nonpersistent emergent
Location:
294,349.661 4,532,112.032 Meters
Field
Value
Id
0
Area
231638.389796
Perimeter
4910.462178
Acres
57.239093
Hectares
23.163839
Vegetation
Nonpersistent emergent
Coverage
0
Notes
Rice cutgrass, chufa, wild millet, rusty nut
Year
2006
Loc
17
Identified 1 feature
Change markup width and transparency
290662.87 4534194.21 Meters

Chautauqua Lake


chautauqua - ArcReader
File Edit View Bookmarks Tools Window Help
1:44,096
1939 Chautauqua Lal
0.70
Highlighter
100%
Layers
1939 Chautauqua Lal
1939 Chautauqua Lal
1940 Chautauqua Lal
1940 Chautauqua Lal
1941 Chautauqua Lal
1941 Chautauqua Lal
1942 Chautauqua Lal
1942 Chautauqua Lal
1944 Chautauqua Lal
1946 Chautauqua Lal
1955 Chautauqua Lal
1956 Chautauqua Lal
1938 Chautauqua Lal
Category
Aquatic bed
Floating-leaved ac
Levee
Nonpersistent em
Open water
Persistent emerge
Scrub-shrub
1939 Chautauqua Lal
1940 Chautauqua Lal
1941 Chautauqua Lal
1942 Chautauqua Lal
1943 Chautauqua Lal
1944 Chautauqua Lal
1946 Chautauqua Lal
1953 Chautauqua Lal
1955 Chautauqua Lal
1956 Chautauqua Lal
1959 Chautauqua Lal
2005 Chautauqua Lal
Category
Aquatic bed
Bottomland forest
Levee
Mud flat
Nonpersistent em
Open water
Persistent emerge
Scrub-shrub
Illinois River
Illinois River
Identify
Identify from:
<Top-most layer>
1938 Chautauqua Lake vegetation
Sago pondweed
Location:
757,577.795 4,474,816.744 Meters
Field
Value
FID
11
Shape
Polygon
Id
0
Area
1323999546.57
Perimeter
476026.822855
Acres
211.075328
Hectares
85.419155
Vegetation
Sago pondweed
Coverage
0
Identified 1 feature
Set a layers transparency value
759771.23 4475166.76 Meters


chautauqua - ArcReader
File Edit View Bookmarks Tools Window Help
1:35,178
1939 Chautauqua Lal
0.70
Highlighter
100%
Layers
1939 Chautauqua Lal
1939 Chautauqua Lal
1940 Chautauqua Lal
1940 Chautauqua Lal
1941 Chautauqua Lal
1941 Chautauqua Lal
1942 Chautauqua Lal
1942 Chautauqua Lal
1944 Chautauqua Lal
1946 Chautauqua Lal
1955 Chautauqua Lal
1956 Chautauqua Lal
1938 Chautauqua Lal
1939 Chautauqua Lal
1940 Chautauqua Lal
1941 Chautauqua Lal
1942 Chautauqua Lal
1943 Chautauqua Lal
1944 Chautauqua Lal
1946 Chautauqua Lal
1953 Chautauqua Lal
1955 Chautauqua Lal
1956 Chautauqua Lal
1959 Chautauqua Lal
2005 Chautauqua Lal
Category
Aquatic bed
Bottomland forest
Levee
Mud flat
Nonpersistent em
Open water
Persistent emerge
Scrub-shrub
Illinois River
Illinois River
Identify
Identify from:
<Top-most layer>
2005 Chautauqua Lake vegetation
Nonpersistent emergent
Location:
755,827.716 4,473,568.354 Mete
Field
Value
AREA
2174369.893969
PERIMETER
15789.839626
ACRES
537.298502
HECTARES
217.436989
VEGETATION
Nonpersistent emergent
COVERAGE
0
NOTES
Sprangletop, redroot nutgrass, cc
Year
2005
Identified 1 feature
Zoom the map layout by a particular percentage
755313.64 4472747.64 Meters

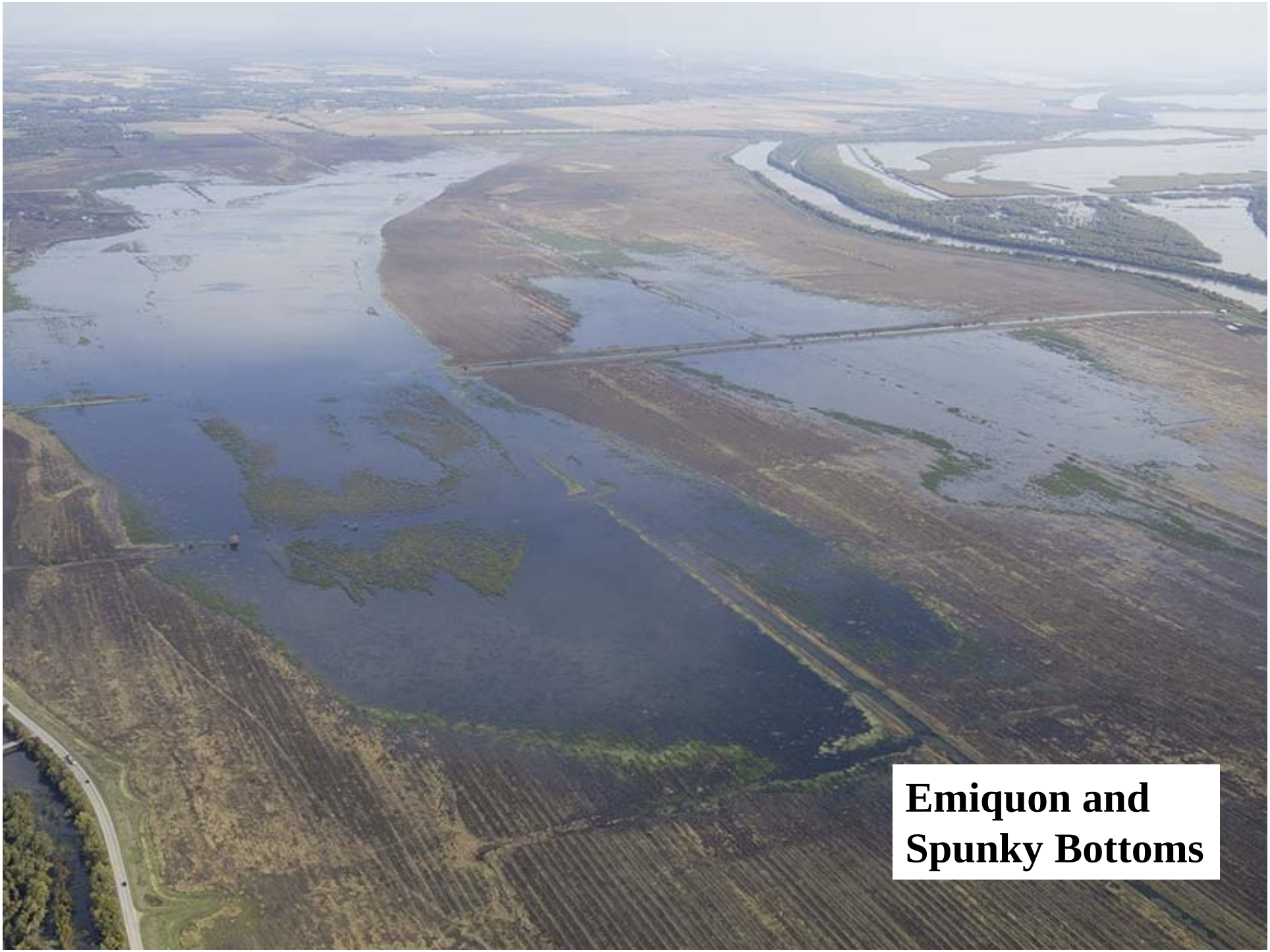
Solutions

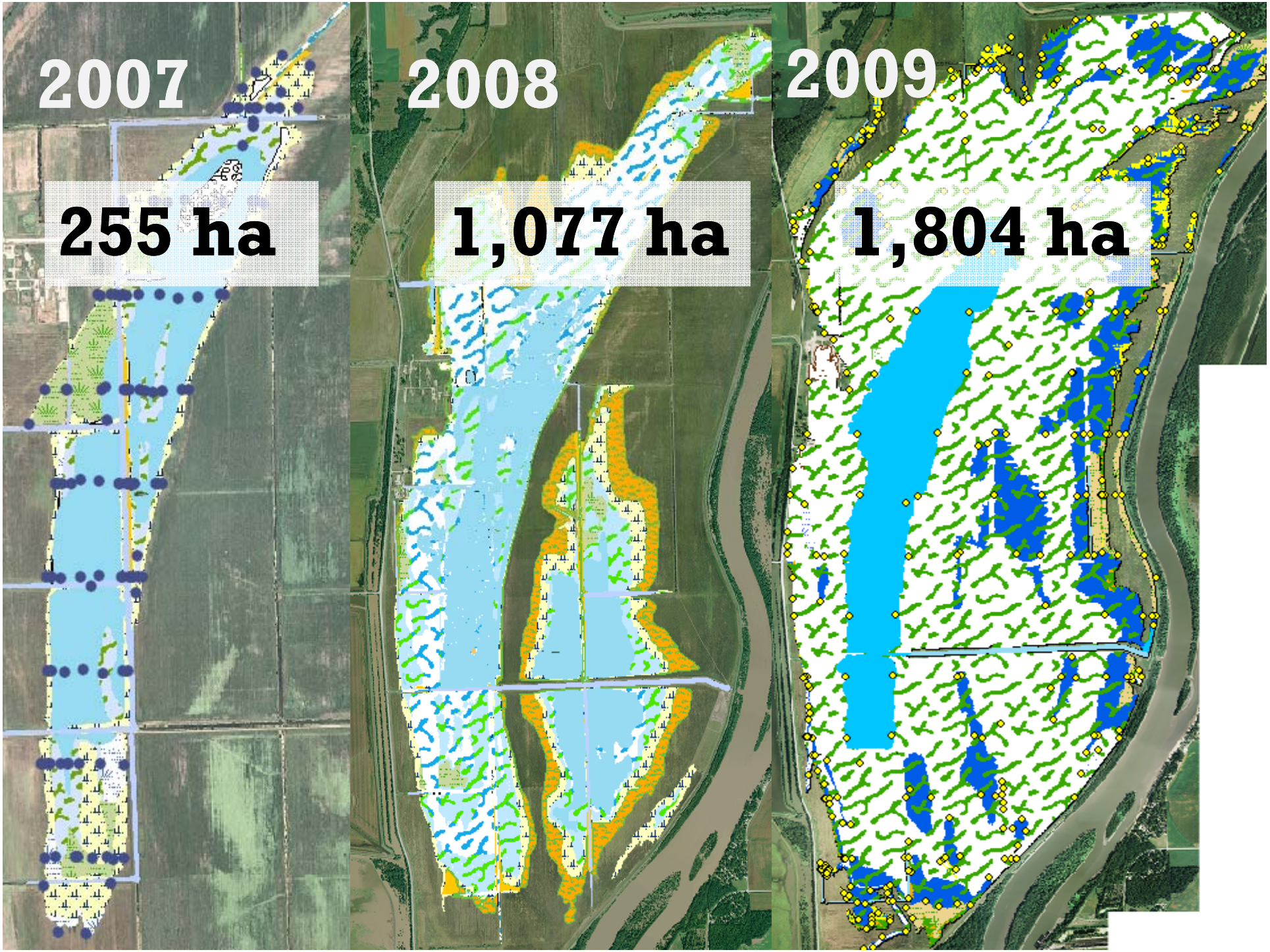
Connected Wetlands

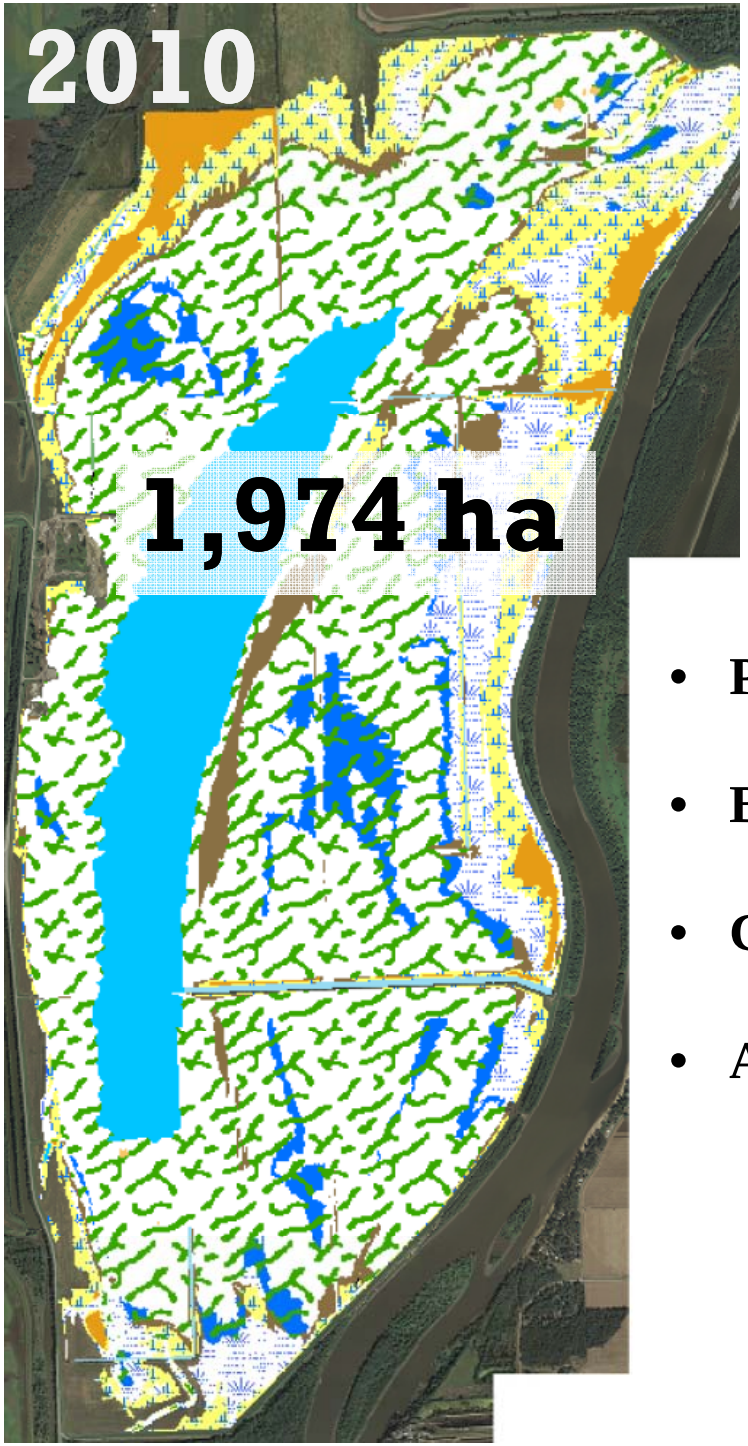
Deepwater habitat
Overwintering fish habitat
Flowing side channels
Structure
Loafing/resting habitat for waterbirds
Bottomland forest

Seasonally Isolated Wetlands


Isolated Wetlands
Hennepin-Hopper


Emiquon and
Spunky Bottoms


2007
255 ha
2008
1,077 ha
2009
1,804 ha



Fall Waterfowl Use-Days

- Pintail UDs 3rd highest for IRV since 1948
- BWT UDs 1st in IRV and Mississippi River valley
- GWT and Gadwall UDs 1st in IRV from 1948-2010
- American Coot UDs 2nd highest for IRV in 2010
  - 1st in IRV in 2009

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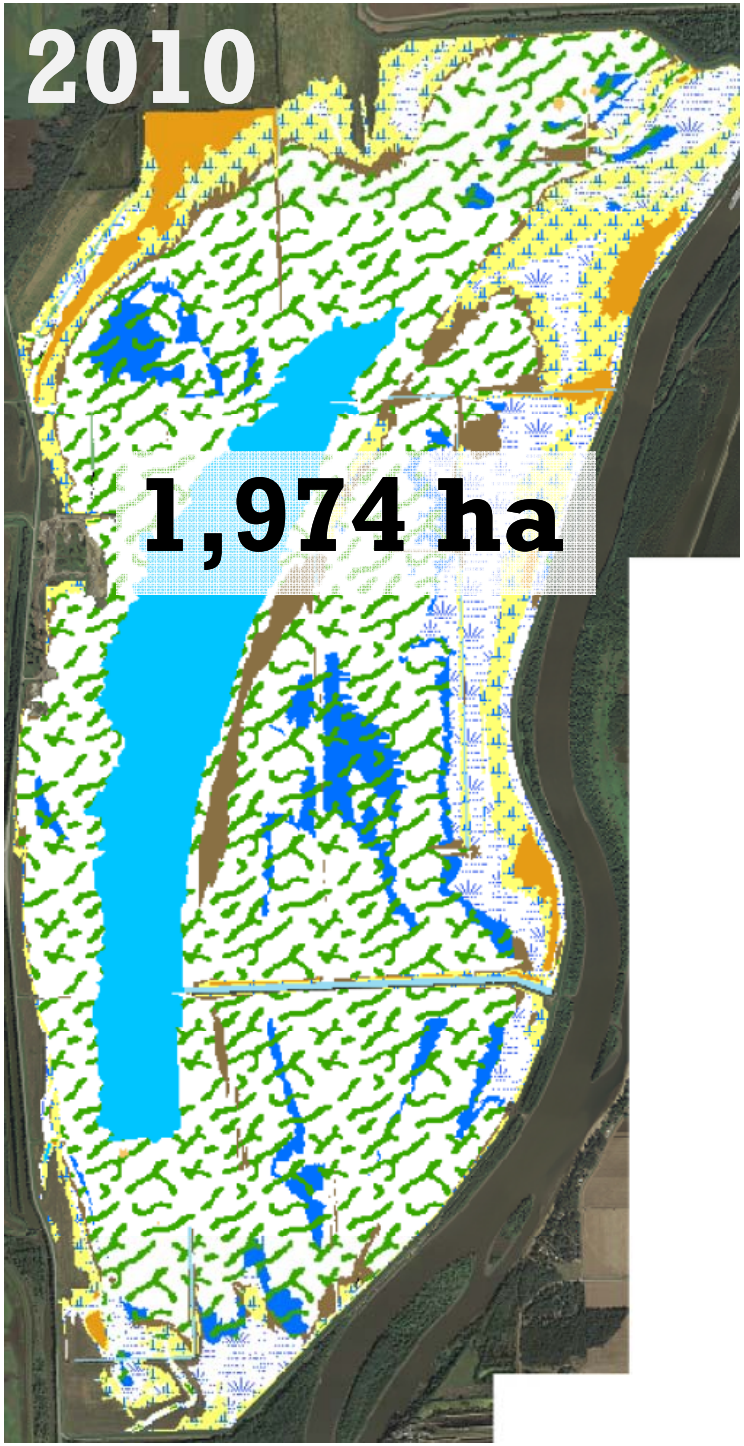

Habitat Diversity

	Hectares			
Habitat Type	**2007**	**2008**	**2009**	**2010**
American Lotus		trace	1	1
Aquatic Bed	3	241	1,186	1,036
Bottom. Forest		trace	1	1
Ditch	19	15	12	14
Hemi-marsh	30	220	290	120
Mudflat	3			83
Moist-Soil	51	127	24	218
Open Water	106	275	221	249
Persistent Emerg.	32	33	44	199
Scrub-shrub	7	1	2	trace
Upland	3	15	1	53
Upland - wet		148	16	
Willow	trace	1	trace	
Total	**255**	**1,077**	**1,804**	**1,974**