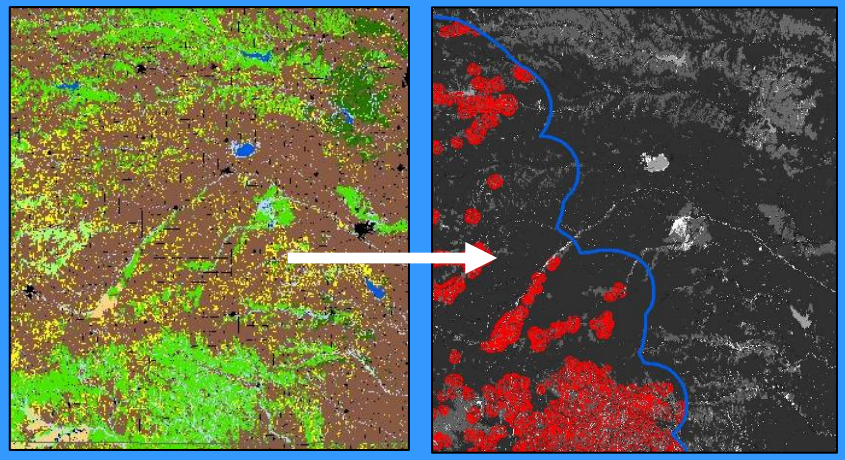
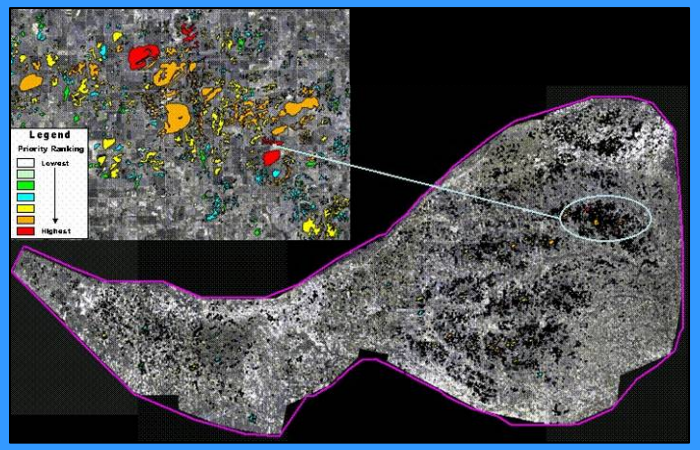
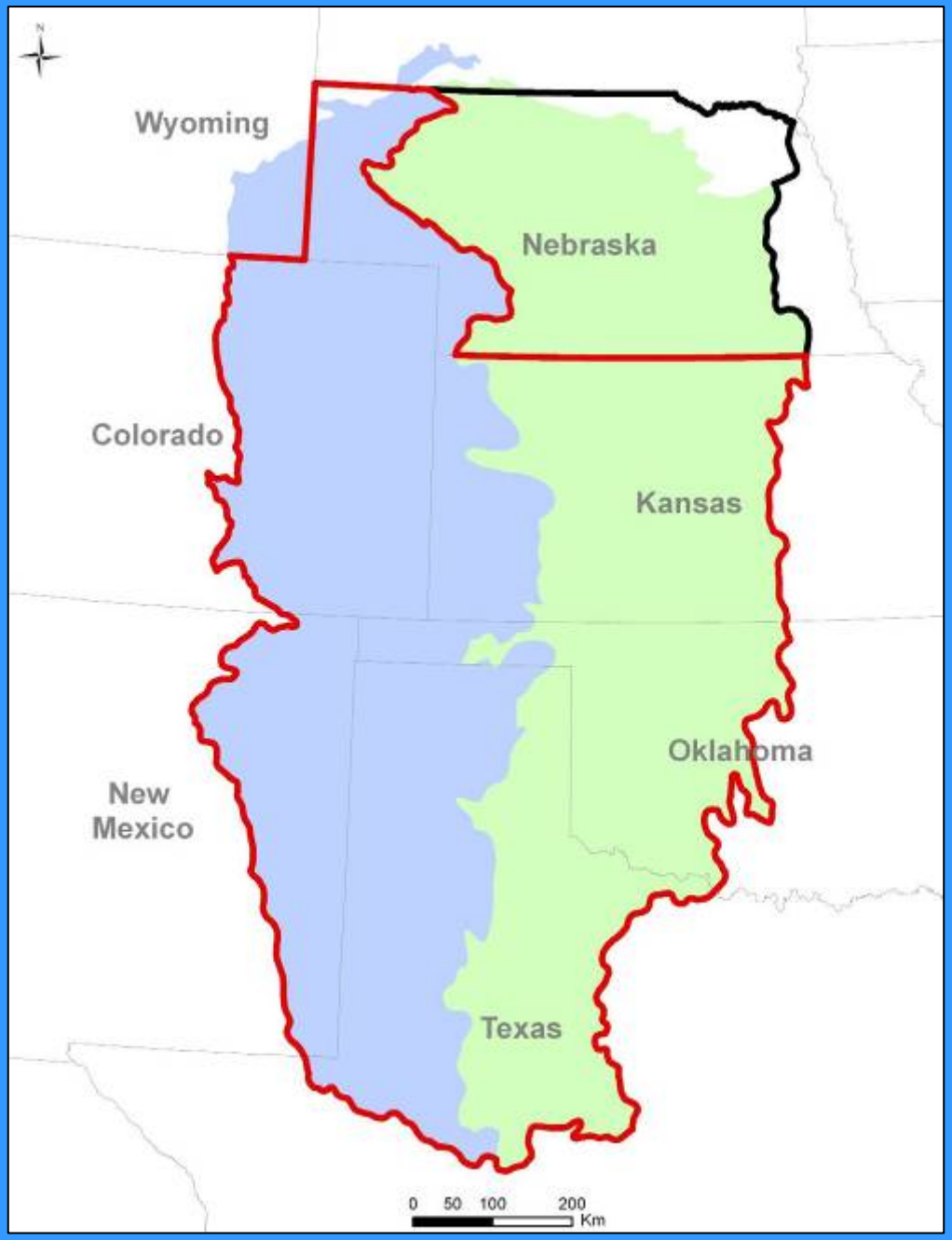
Development and Application of a Regional and Local Landcover for Evaluating Bird Habitat and Conservation Impacts





Megan McLachlan, Playa Lakes Joint Venture

Ryan Reker, Rainwater Basin Joint Venture



Who we are…
Where we work…

PLAYA LAKES JOINT VENTURE

RAINWATER BASIN JOINT VENTURE

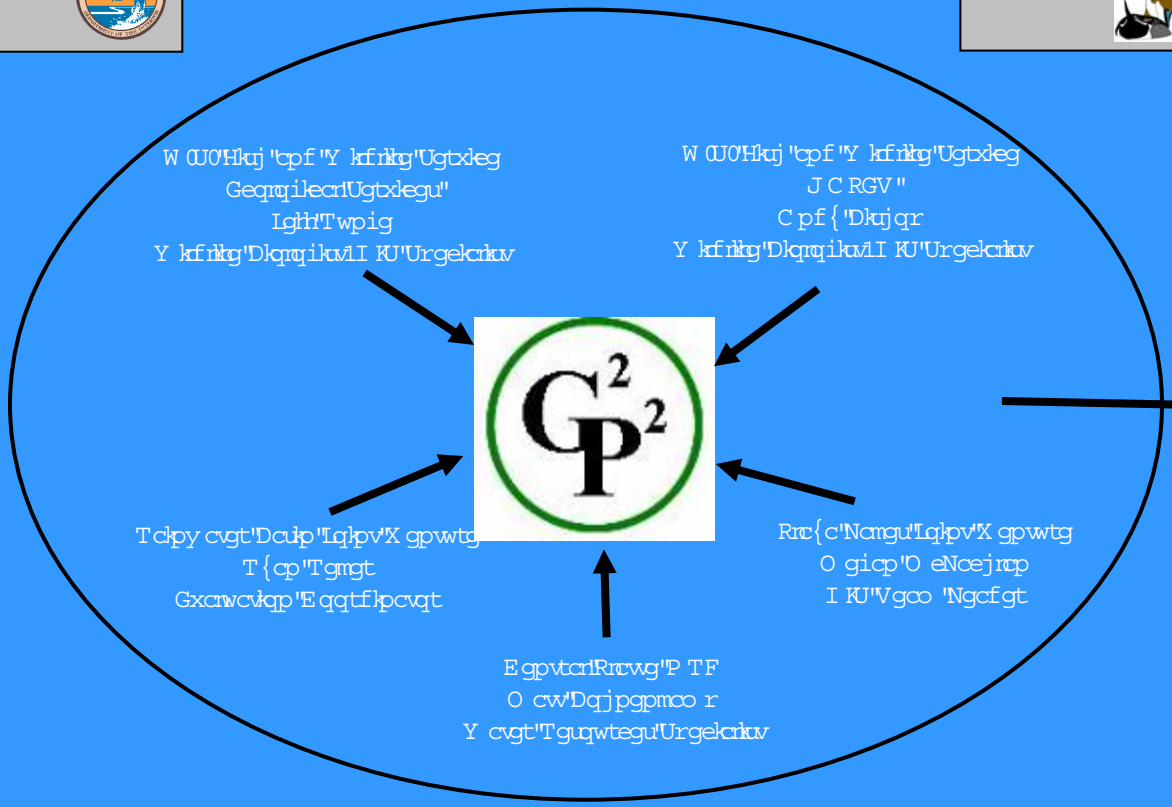
Legend

- PLJV
- RWBJV
- Shortgrass Prairie BCR
- Mixed-grass Prairie BCR

U.S. Fish and Wildlife Service
Nebraska Field Office

Great Plains GIS Partnership

U.S. Fish and Wildlife Service
Habitat and Population
Evaluation Team



Temp Position

Tallgrass Prairie
Partnership
Great Plains GIS Partnership

Rainwater Basin Joint Venture

Central Platte
Natural Resources
District

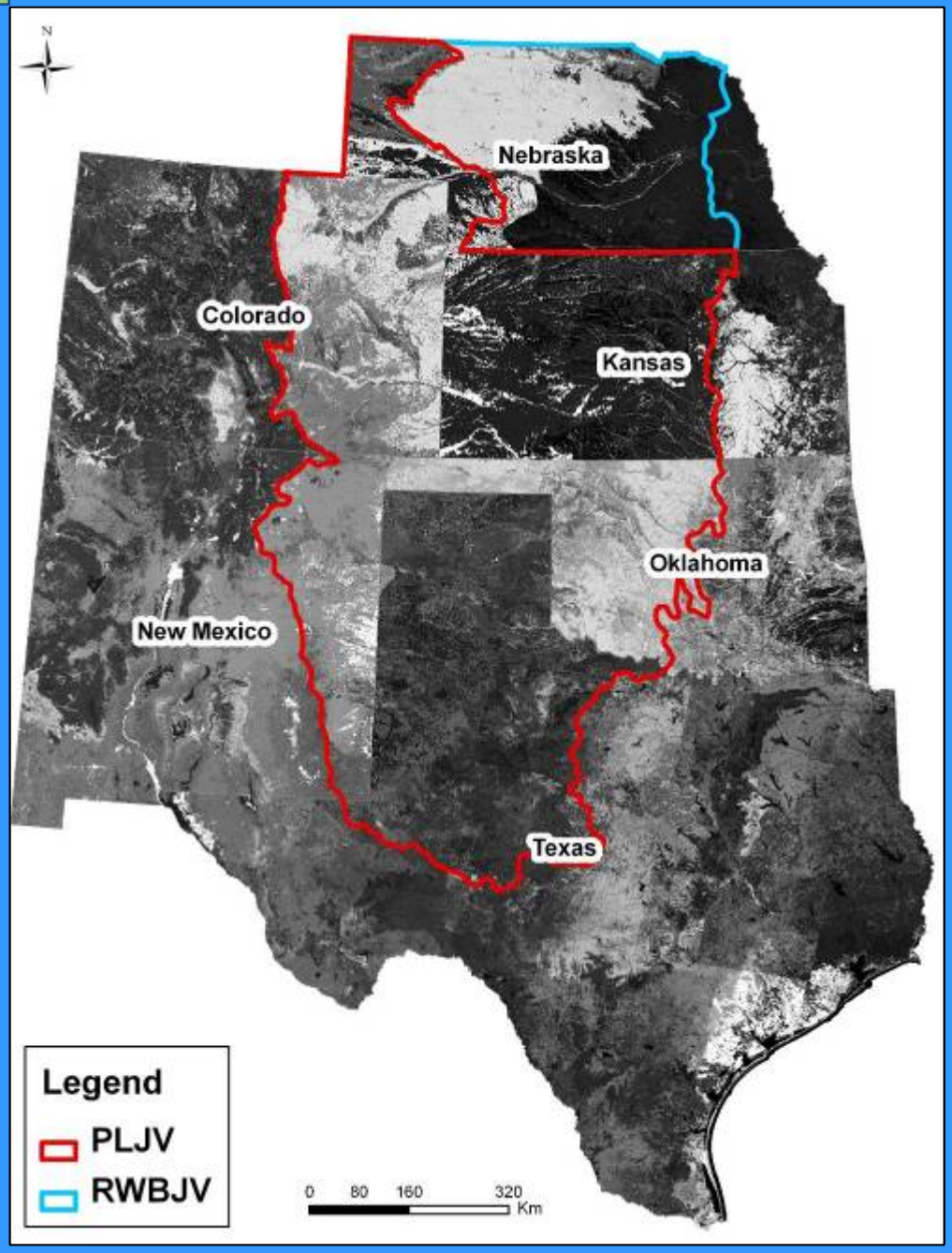
Playa Lakes Joint Venture

Why does PLJV need a landcover?

- **Our job:** Guide where and how much bird conservation work should be done

- **Must know:** Amount, type, and distribution of habitats available to birds in PLJV



Landcovers

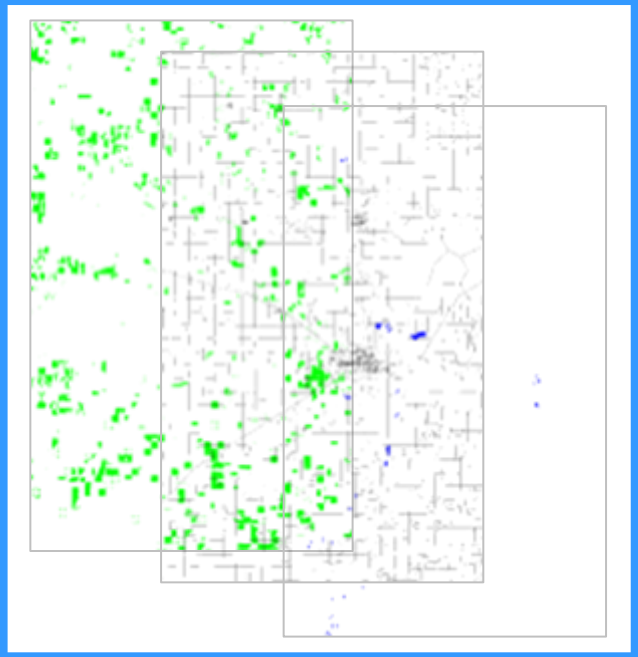
- Ecological Systems
  - NE, KS
- ReGap
  - CO, NM
- Gap
  - OK, TX

Resolutions Vary

- Thematic
- Spatial
- Temporal

Ancillary Data

- Stacked on top of landcover
- Varied by availability among states
- Examples
  - Roads
  - NWI
  - Saline Lakes
  - Playas
  - Eastern Red Cedar
  - CLU: CRP, crop fields
  - NHD
  - NASS



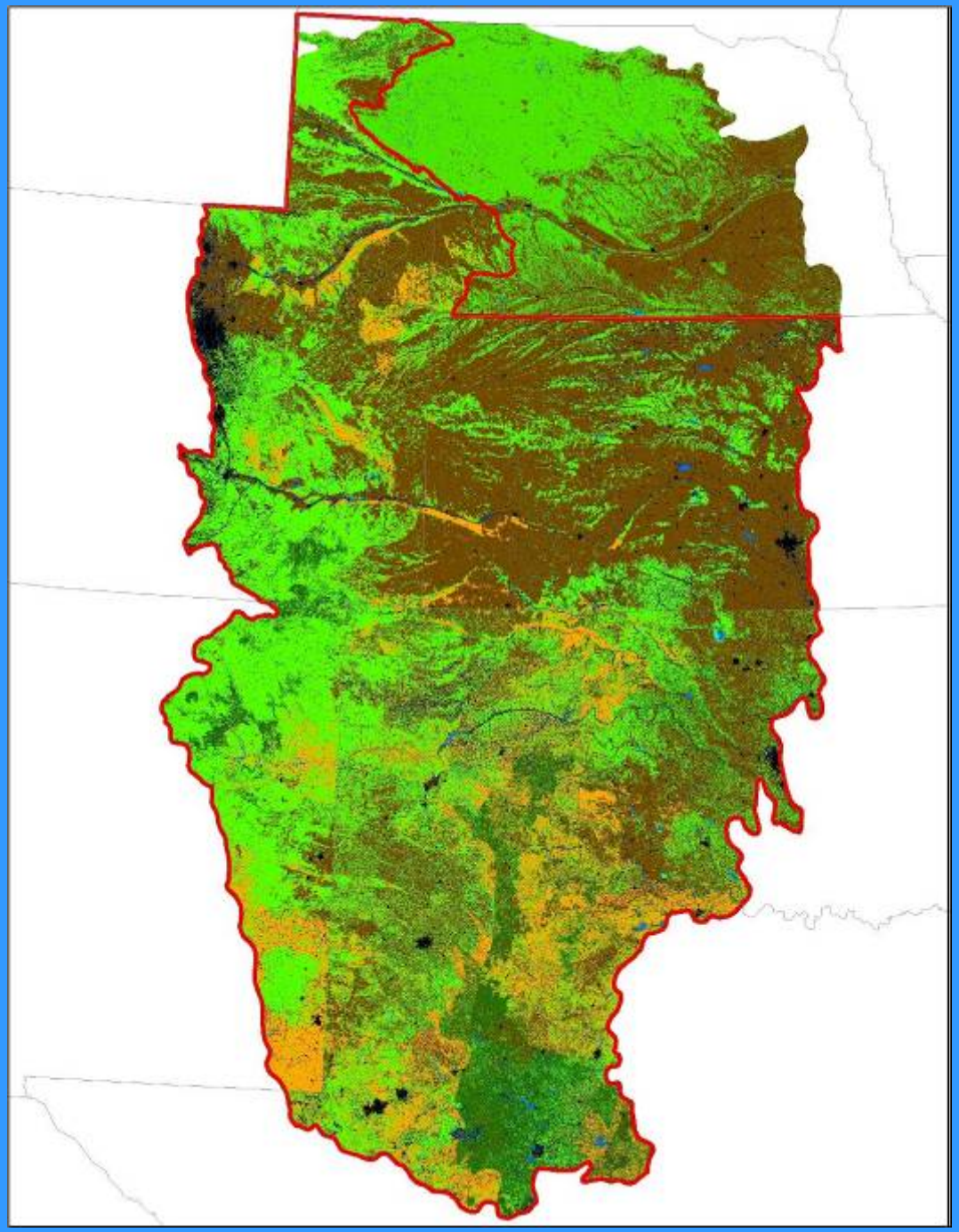
Associations and Conditions

- Includes all classes from base landcovers and ancillary data

- **Association** – landcover class
  - *ex. Cropland*
- **Condition** – characteristics important to birds
  - *ex. Corn vs. wheat*

25 Associations
74 Conditions

"DIVISION"	"TYPE"	ASSOCIATION	CONDITION
Aquatic	Open Water	1- Reservoirs Lakes Ponds	101 - Freshwater lake
			102 - Lagoon
			103 - Pit
			104 - Reservoir
			106 - Stock pond
	Wetlands	12 - Playas	
		13 - Sandhills Wetlands[1]	
		14 - Rainwater Basins	
			143 - Late successional
		15 - Other Wetlands	151 - Moist-soil unit
			152 - Emergent marsh
			153 - Saline
	Riverine Systems	24 - Riverine Systems	241 - Riparian canopy (early succ. w/o understory)
			241 - Riparian canopy (early succ. with understory)
			241 - Riparian canopy (late succ. w/o understory)
			241 - Riparian canopy (late succ. with understory)
			242 - Exotic Riparian shrubland
			243 - Native Riparian shrubland
			244 - River channel
			245 - Unvegetated sandbar
			246 - Warmwater slough
			247 - Wet meadow
			248 - Floodplain marsh
		27 - Arroyo/Ravine [2]	
Anthropogenic	Agricultural	38 - Cropland	201 - Alfalfa
			202 - Corn
			203 - Fallow
			204 - Hay
			205 - Millet
			206 - Sorghum
			207 - Soybeans
			208 - Sunflowers
			209 - Wheat
			210 - Peanuts
			37 - Pasture
			211 - Other
			212 - Sod Farm
		39 - CRP	31 - Grass
			32 - Trees - upland
			33 - Trees - riparian
			34 - Wetland
			35 - Wetland - playa/non-floodplain
			36 - CRP other practices
Other	Other	40 - Other	46 - Urban/Suburban
			44 - 4-lane roads
			41 - Other roads
			48 - All other types not important to SMA-Hs
Terrestrial	Sparsely Vegetated	51 - Badlands/Cliffs/Outcrops	
	Forests/Woodlands	61 - Forest/Woodland (upland)	Shelterbelts
			59 - Eastern Red Cedar
		62 - Pinyon/Juniper	
		63 - Ponderosa Pine	69 - Few trees, grassy understory
			60 - Many trees, little grassy understory
		64 - Crosstimbers Woodland	
		65 - Hillside Woodland	
		66 - Juniper	
		67 - Juniper/Mesquite	
	Grasslands	71 - Mixed Grass	Few shrubs/Low grass
			Few shrubs/High grass
			Many shrubs/Low grass
			Many shrubs/High grass
			Prairie Dog Colony[3]
		73 - Sandhills Grasslands[1]	Few shrubs/Low grass
			Few shrubs/High grass
			Many shrubs/Low grass
			Many shrubs/High grass
		75 - Shortgrass	Few shrubs/Low grass
			Few shrubs/High grass
			Many shrubs/Low grass
			Many shrubs/High grass
			Prairie Dog Colony[3]
		77 - Tallgrass	Few shrubs/Low grass
			Few shrubs/High grass
			Many shrubs/Low grass
			Many shrubs/High grass
	Shrublands	83 - Mesquite Savannah	81 - Savannah
			82 - Shrubland
		85 - Shinnery	Few shrubs/Low grass
			Many shrubs/ Low grass
			Few shrubs/High grass
			Many shrubs/High grass
		87 - Sand Sage	Low grass
			High grass


Legend
PLJV
Landcover
Barren
Cropland
Woodland
Shrubland
Grassland
Other
Wetland
Water
Riverine

How do we use it?

Tools:

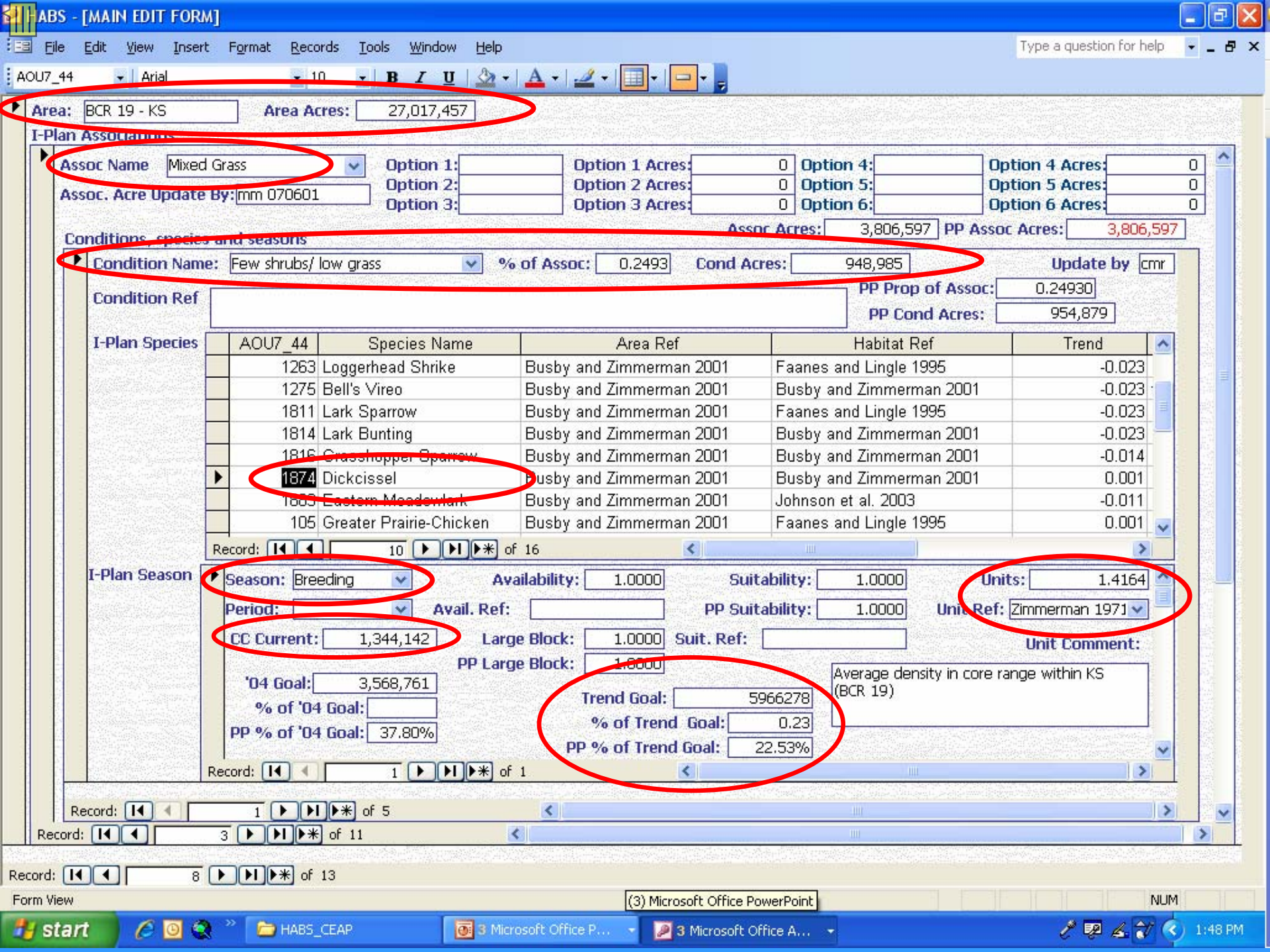
- HABS – Hierarchical All Bird System
- GIS – Geographic Information System

Data:

- Habitat acres from seamless landcover
- Bird densities and use-days
- Bird population goals

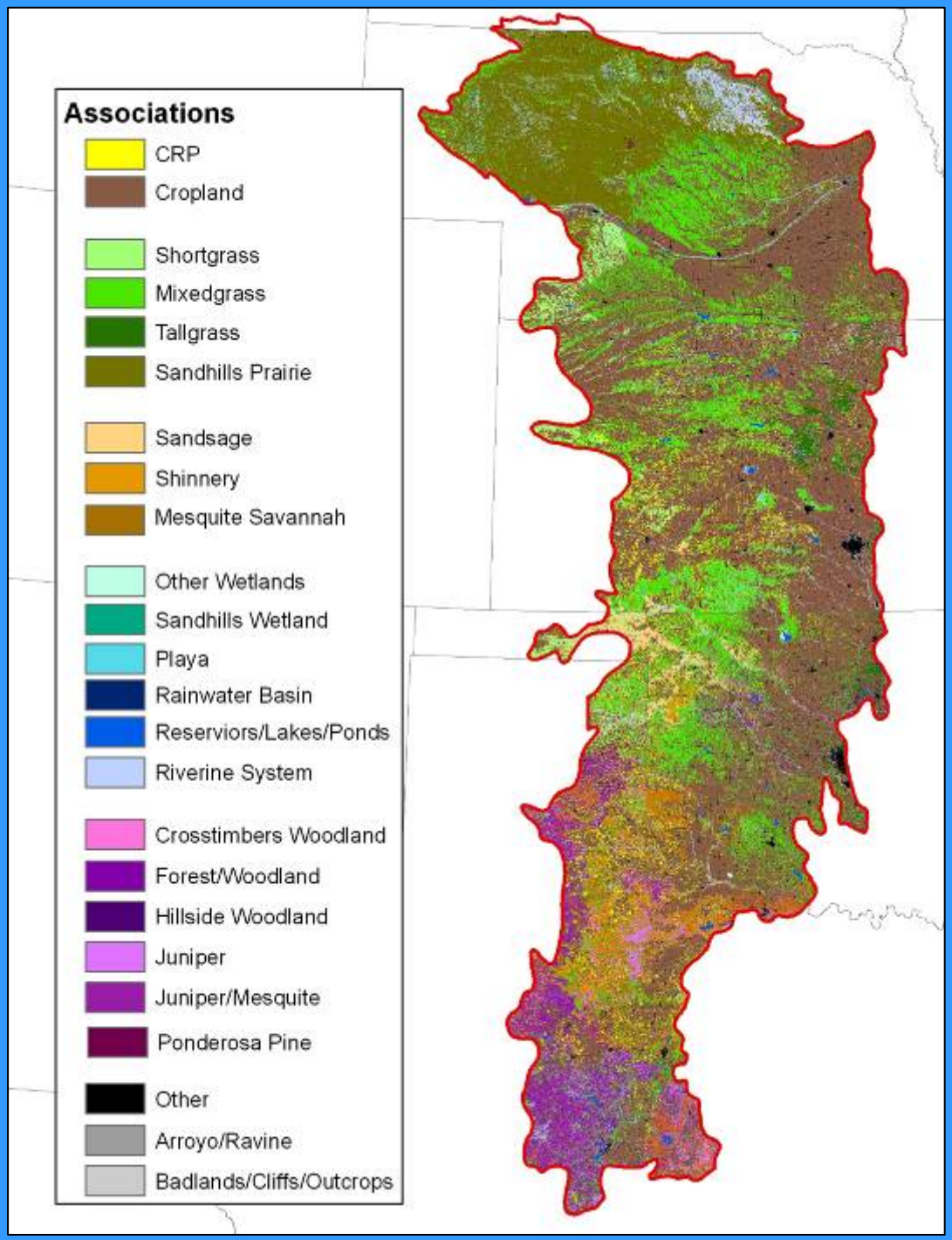
- RMBO

NAWMP
PIF
USSCP
WA


HABS - [MAIN EDIT FORM]
File Edit View Insert Format Records Tools Window Help
Type a question for help
AOU7_44 Arial 10
Area: BCR 19 - KS
Area Acres: 27,017,457
I-Plan Associations
Assoc Name Mixed Grass
Assoc. Acre Update By: mm 070601
Option 1: Option 1 Acres: 0 Option 4: Option 4 Acres: 0
Option 2: Option 2 Acres: 0 Option 5: Option 5 Acres: 0
Option 3: Option 3 Acres: 0 Option 6: Option 6 Acres: 0
Assoc Acres: 3,806,597 PP Assoc Acres: 3,806,597
Conditions, species and seasons
Condition Name: Few shrubs/ low grass
% of Assoc: 0.2493
Cond Acres: 948,985
Update by cmr
Condition Ref
PP Prop of Assoc: 0.24930
PP Cond Acres: 954,879
I-Plan Species
AOU7_44 Species Name Area Ref Habitat Ref Trend
1263 Loggerhead Shrike Busby and Zimmerman 2001 Faanes and Lingle 1995 -0.023
1275 Bell's Vireo Busby and Zimmerman 2001 Busby and Zimmerman 2001 -0.023
1811 Lark Sparrow Busby and Zimmerman 2001 Faanes and Lingle 1995 -0.023
1814 Lark Bunting Busby and Zimmerman 2001 Busby and Zimmerman 2001 -0.023
1816 Grasshopper Sparrow Busby and Zimmerman 2001 Busby and Zimmerman 2001 -0.014
1874 Dickcissel Busby and Zimmerman 2001 Busby and Zimmerman 2001 0.001
1883 Eastern Meadowlark Busby and Zimmerman 2001 Johnson et al. 2003 -0.011
105 Greater Prairie-Chicken Busby and Zimmerman 2001 Faanes and Lingle 1995 0.001
Record: 10 of 16
I-Plan Season
Season: Breeding
Availability: 1.0000
Suitability: 1.0000
Units: 1.4164
Period:
Avail. Ref:
PP Suitability: 1.0000
Unit Ref: Zimmerman 1971
CC Current: 1,344,142
Large Block: 1.0000
Suit. Ref:
Unit Comment:
PP Large Block: 1.0000
'04 Goal: 3,568,761
% of '04 Goal:
PP % of '04 Goal: 37.80%
Trend Goal: 5966278
% of Trend Goal: 0.23
PP % of Trend Goal: 22.53%
Average density in core range within KS (BCR 19)
Record: 1 of 1
Record: 1 of 5
Record: 3 of 11
Record: 8 of 13
Form View
NUM
(3) Microsoft Office PowerPoint
start
HABS_CEAP
3 Microsoft Office P...
3 Microsoft Office A...
1:48 PM

CEAP:

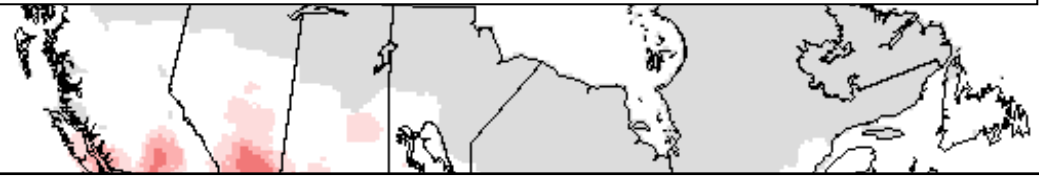
Effect of CRP on Mixed-grass Prairie Birds



Ring-necked Pheasant


Dave Herr

BBS Relative Abundance Map

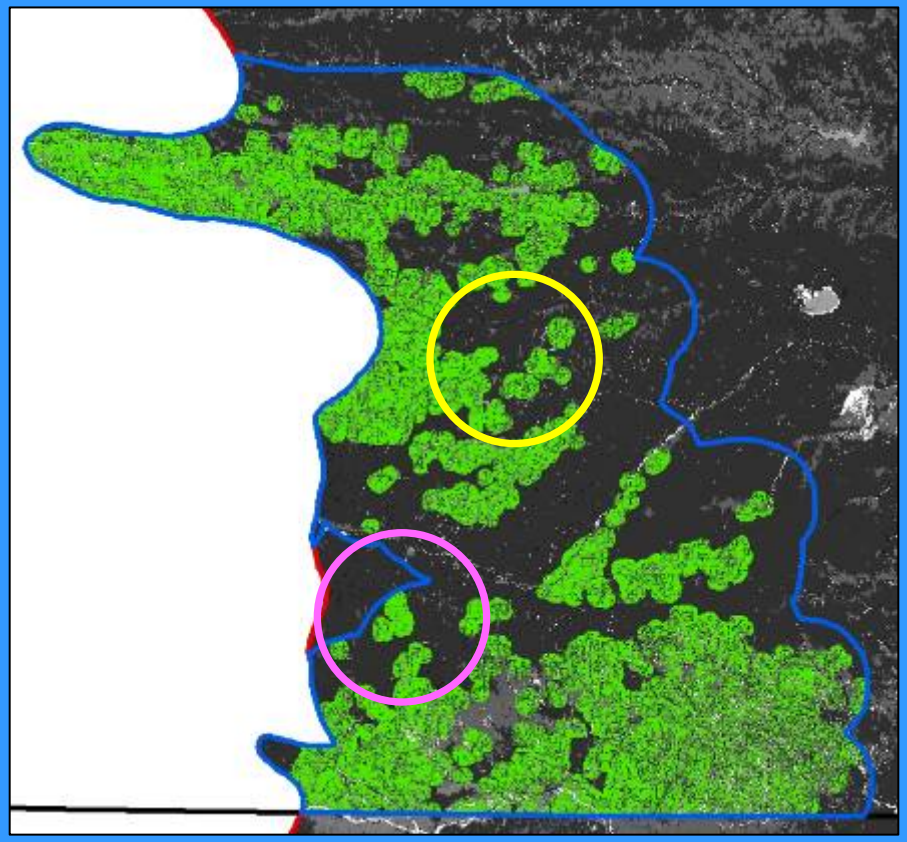


	Ring-necked Pheasant	CRP		CRP to Cropland	
State	Pop. Goal	Carrying Capacity	Perc. Pop. Goal	Carrying Capacity Lost/Gained	Perc. Pop. Goal Lost/Gained
KS	76,510	39,140	51%	-35,986	- 47%
NE	109,037	7,320	7%	-6,123	- 6%
OK	16,046	1,616	10%	-992	- 6%
TX	13,901	4,009	29%	-3,035	- 22%
	- 47%	- 6%	- 6%	- 22%	- 21%

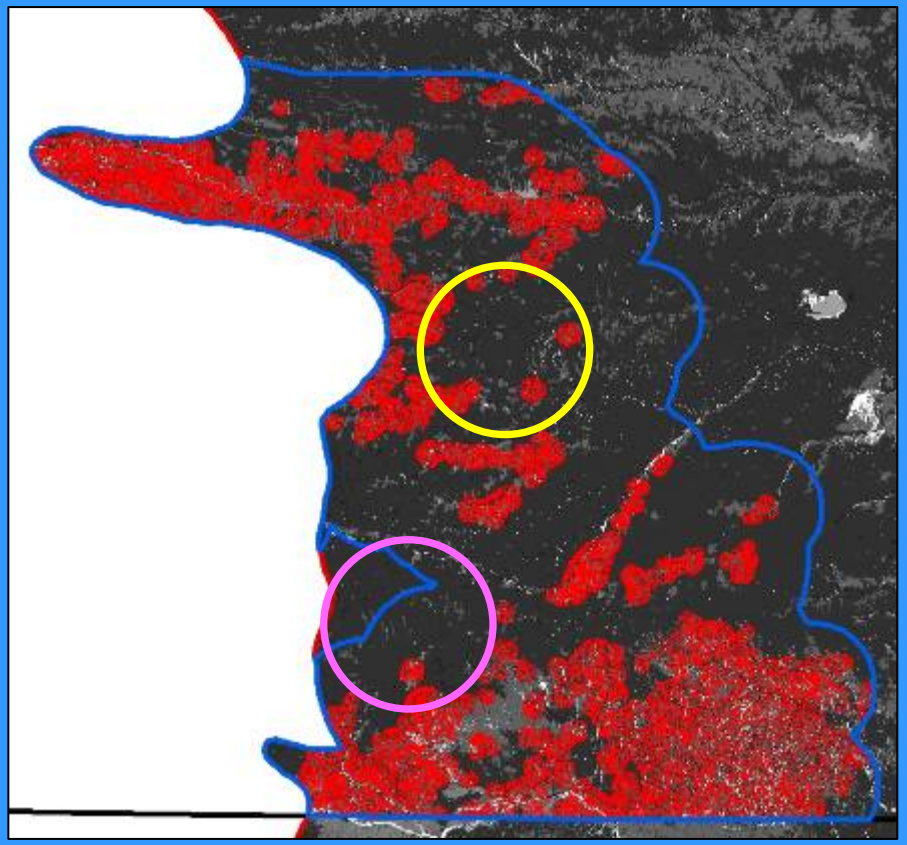
Spatial Models

Lesser Prairie-chicken range in Kansas (BCR19)

With CRP



CRP → Cropland



Strengths of PLJV Landcover

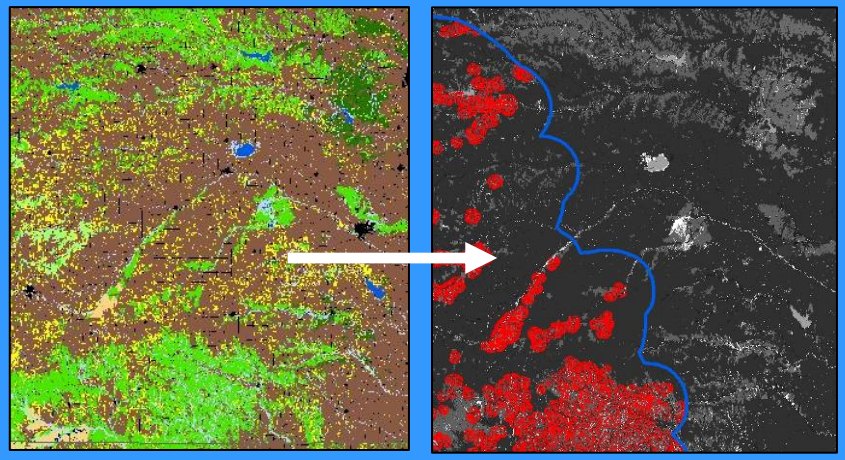
- Seamless across state boundaries
  - Conduct landscape scale spatial analysis
  - Compare “apples to apples”

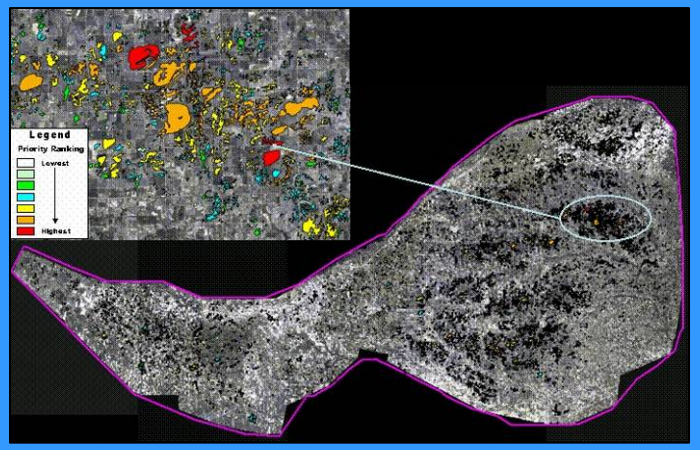
- Landcover classes are relevant to birds

Weaknesses of PLJV Landcover

- Compounded error of multiple layers
- No accuracy assessment
  - In initial planning phase
- Spatial data on many Conditions are unavailable (e.g., crop type)
  - Know “how much” but not “where”

Development and Application of a Regional and Local Landcover for Evaluating Bird Habitat and Conservation Impacts



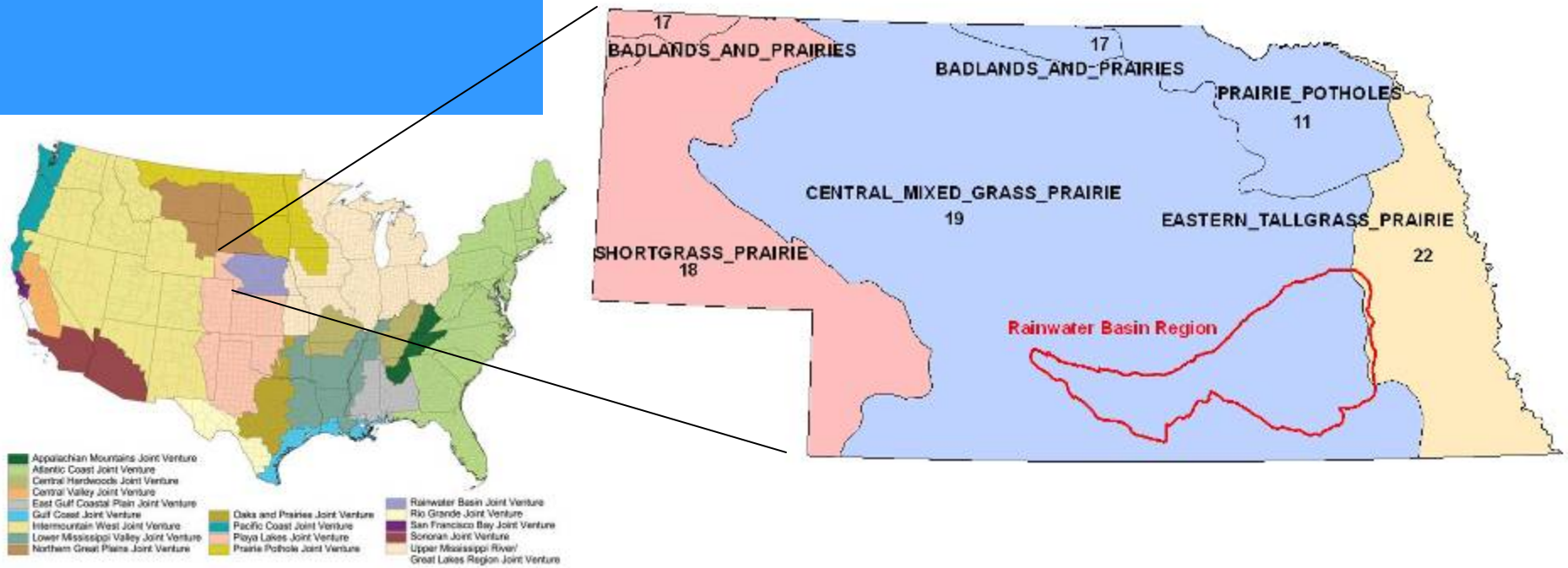


Megan McLachlan, Playa Lakes Joint Venture

Ryan Reker, Rainwater Basin Joint Venture

Joint Ventures in Nebraska

- Playa Lakes JV (BCR-18, 17)
- Rainwater Basin JV (BCRs-19,17,11)
- Upper Mississippi Valley and Great Lakes JV (BCR-22)



Rainwater Basins Important Bird-Use Area

- Millions of waterfowl use RWB wetland complex as a critical resting & refueling stop during spring migration
  - 200,000 – 300,000 Shorebirds
  - 50% of Mid-Continent Mallards
  - 30% of all Northern Pintails
  - 90% of all White-Front Geese
  - Over 2 Million Snow Geese
  - 6-7 Million Waterfowl

Rainwater Basin Joint Venture

- Playa Lakes Joint Venture
  - Multi-state in scale
  - Focused primarily on regional bird planning
- Rainwater Basin Joint Venture
  - Originally, very local in scale (17 counties)
  - Heavily involved in project implementation
  - Increasingly moving towards more integrated approach -

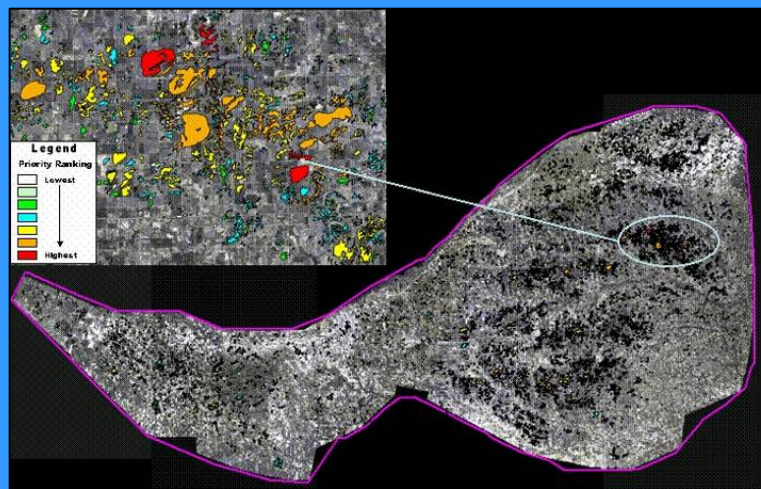
Bird Planning

AND

Project Implementation

Need for More Detailed Spatial Data

- Over 85% of historic Rainwater Basin wetlands lost to agricultural conversion
  - JV and partners in wetland restoration mode
- RWBJV Office provides detailed decision support tools to partners on where to put the best projects on the ground
- Need detailed spatial data in order to create protection and restoration models, decision support tools



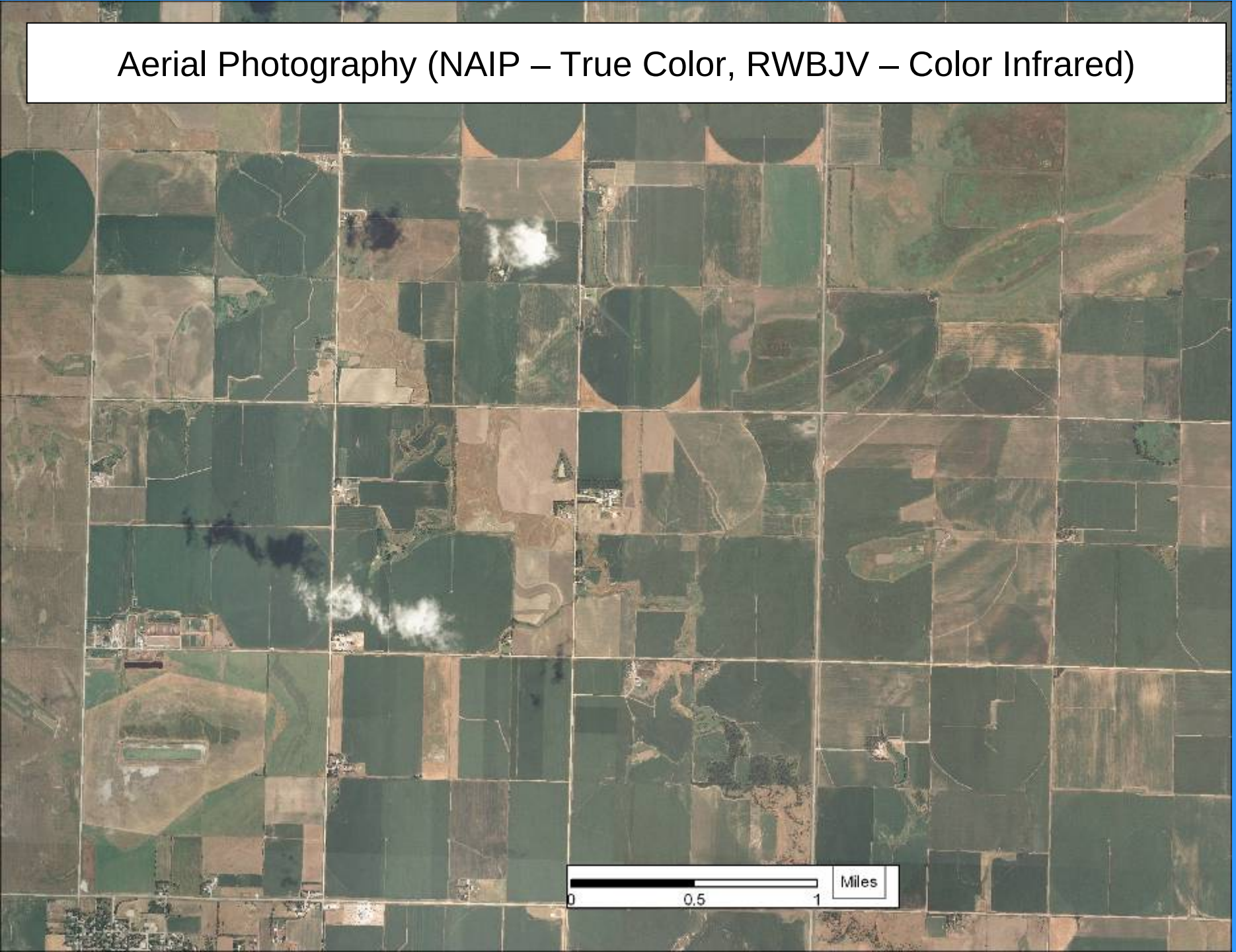
Creation of a Detailed Landcover

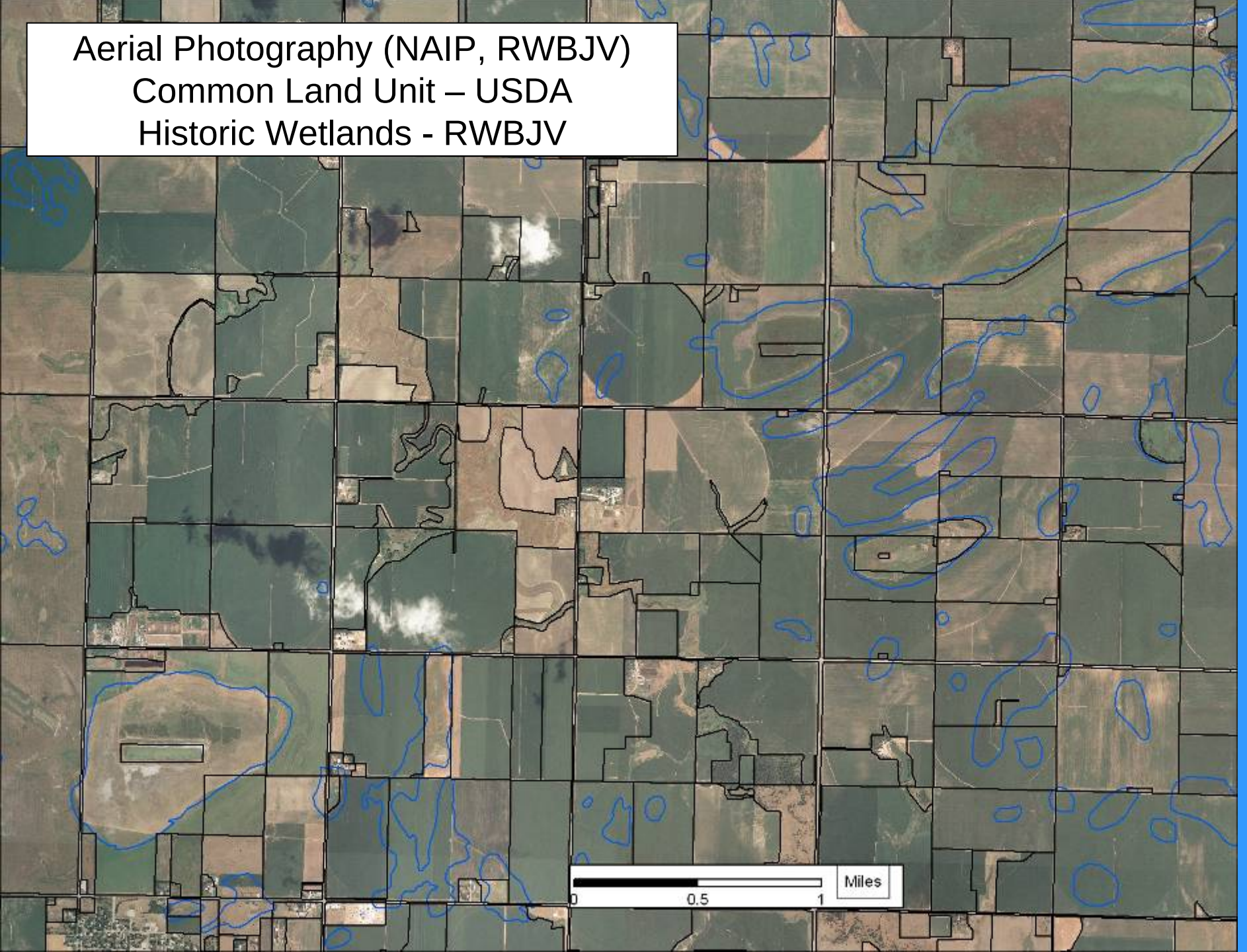
- Existing landcover data (NLCD, GAP)
  - Too outdated
  - Lacked necessary detail upon which to build detailed decision support tools and to model at the desired level (individual field level)
- NLCD and GAP use NWI for their wetland data
  - Original NWI mapping for RWB not useable
  - JV had to create our own wetlands layer

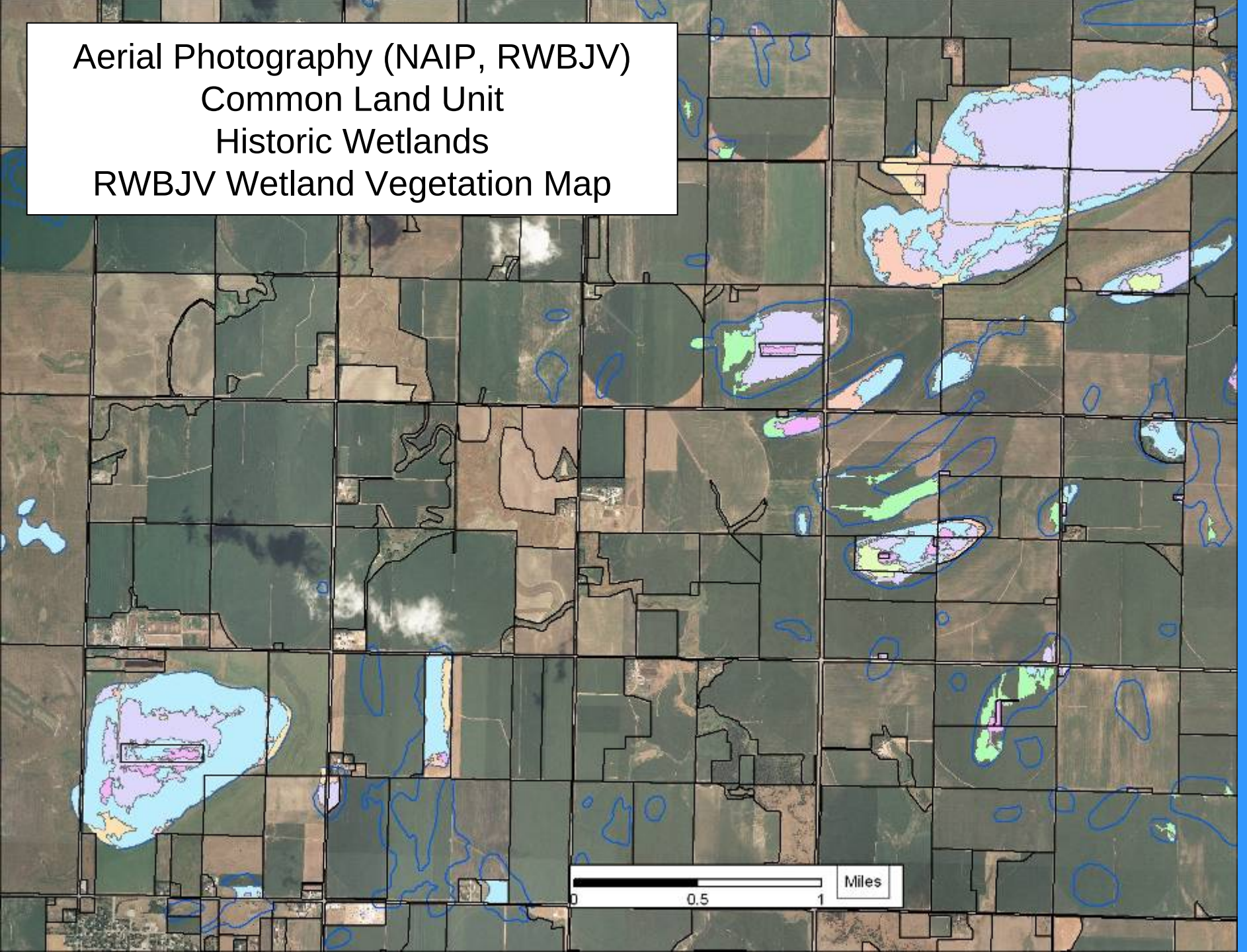
Creation of a Detailed Landcover

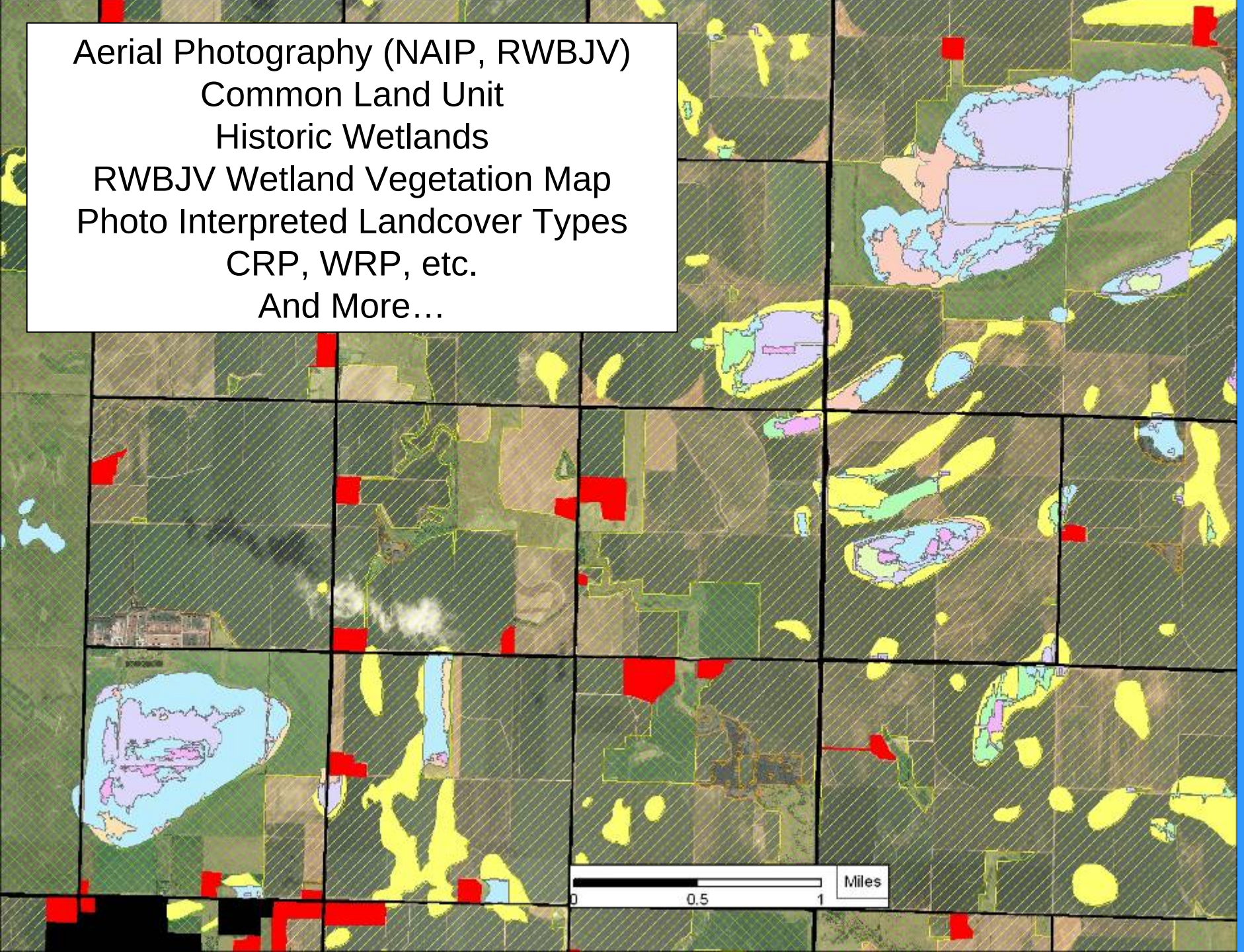
- **USDA Common Land Unit**
  - Use CLU-NMBR field to differentiate between Ag – Not Ag
- **GIS Technicians integrate existing spatial data**
  - Native Prairie Surveys
  - Nebraska Heritage Program Data
  - RWBJV - Wetland Vegetation Mapping
  - RWBJV - Historic Wetland Boundaries
  - Roads/Towns
- **Photo interpret visually identifiable landcover types**
  - Agriculture
    - Pivots, Corners, Flood
  - Trees
  - Grass
  - Canals
  - Developed
  - Irrigation Reuse Pits
  - Wetland Concentration Pits
  - Roads (from CLU)
  - CAFO

Aerial Photography (NAIP – True Color, RWBJV – Color Infrared)




Aerial Photography (NAIP, RWBJV)
Common Land Unit – USDA
Historic Wetlands - RWBJV
0
0.5
1
Miles


Aerial Photography (NAIP, RWBJV)
Common Land Unit
Historic Wetlands
RWBJV Wetland Vegetation Map
Miles
0
0.5
1


Aerial Photography (NAIP, RWBJV)
Common Land Unit
Historic Wetlands
RWBJV Wetland Vegetation Map
Photo Interpreted Landcover Types
CRP, WRP, etc.
And More…
0
0.5
1
Miles

Rainwater Basin Landcover (2005)

Rainwater Basin Joint Venture

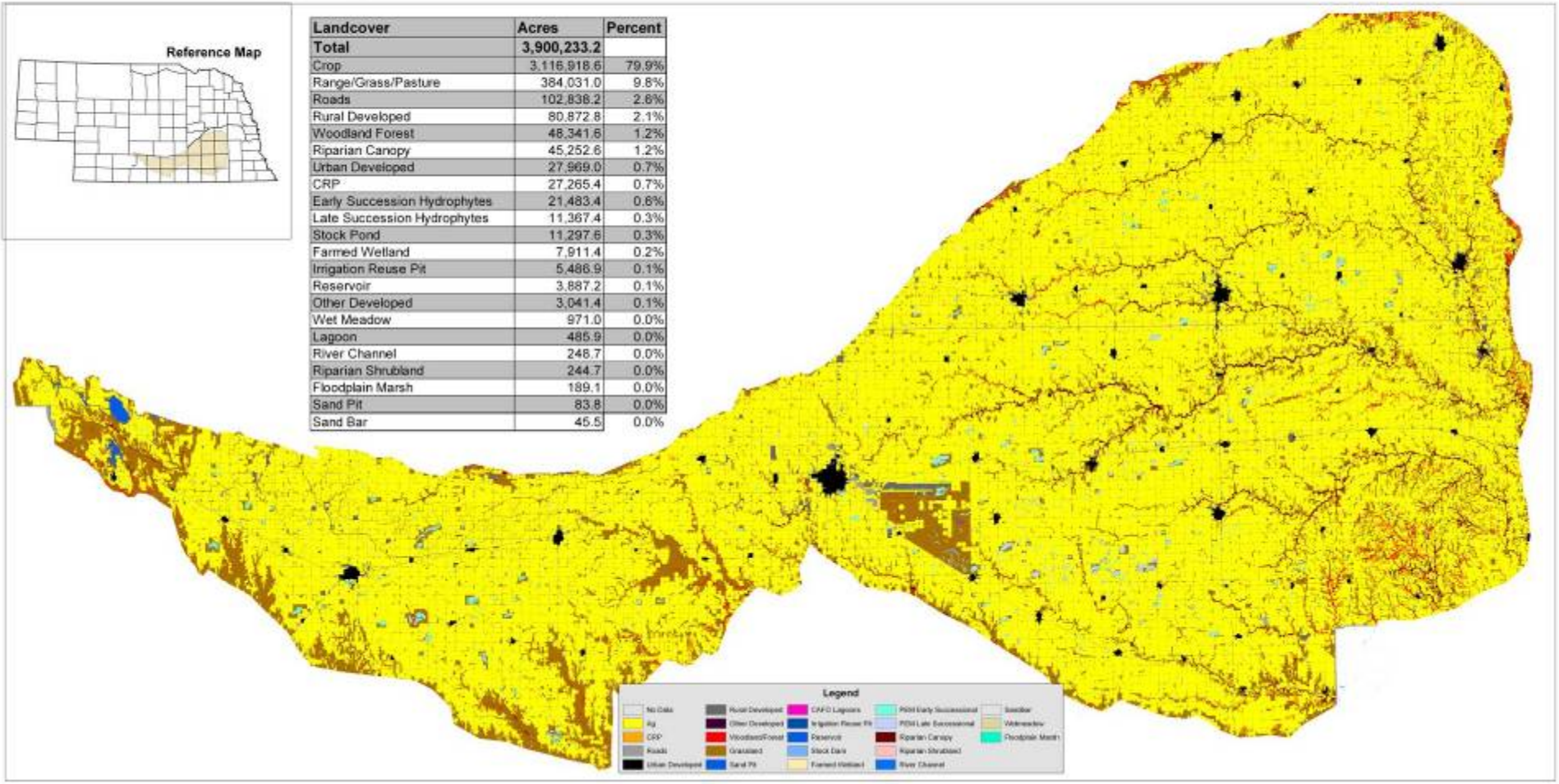
Rainwater Basin Wetland Complex

South Central Nebraska

2004 Landuse

Reference Map

Landcover	Acres	Percent
Total	**3,900,233.2**	
Crop	3,116,918.6	79.9%
Range/Grass/Pasture	384,031.0	9.8%
Roads	102,838.2	2.6%
Rural Developed	80,872.8	2.1%
Woodland Forest	48,341.6	1.2%
Riparian Canopy	45,252.6	1.2%
Urban Developed	27,969.0	0.7%
CRP	27,265.4	0.7%
Early Succession Hydrophytes	21,483.4	0.6%
Late Succession Hydrophytes	11,367.4	0.3%
Stock Pond	11,297.6	0.3%
Farmed Wetland	7,911.4	0.2%
Irrigation Reuse Pit	5,486.9	0.1%
Reservoir	3,887.2	0.1%
Other Developed	3,041.4	0.1%
Wet Meadow	971.0	0.0%
Lagoon	485.9	0.0%
River Channel	248.7	0.0%
Riparian Shrubland	244.7	0.0%
Floodplain Marsh	189.1	0.0%
Sand Pit	83.8	0.0%
Sand Bar	45.5	0.0%

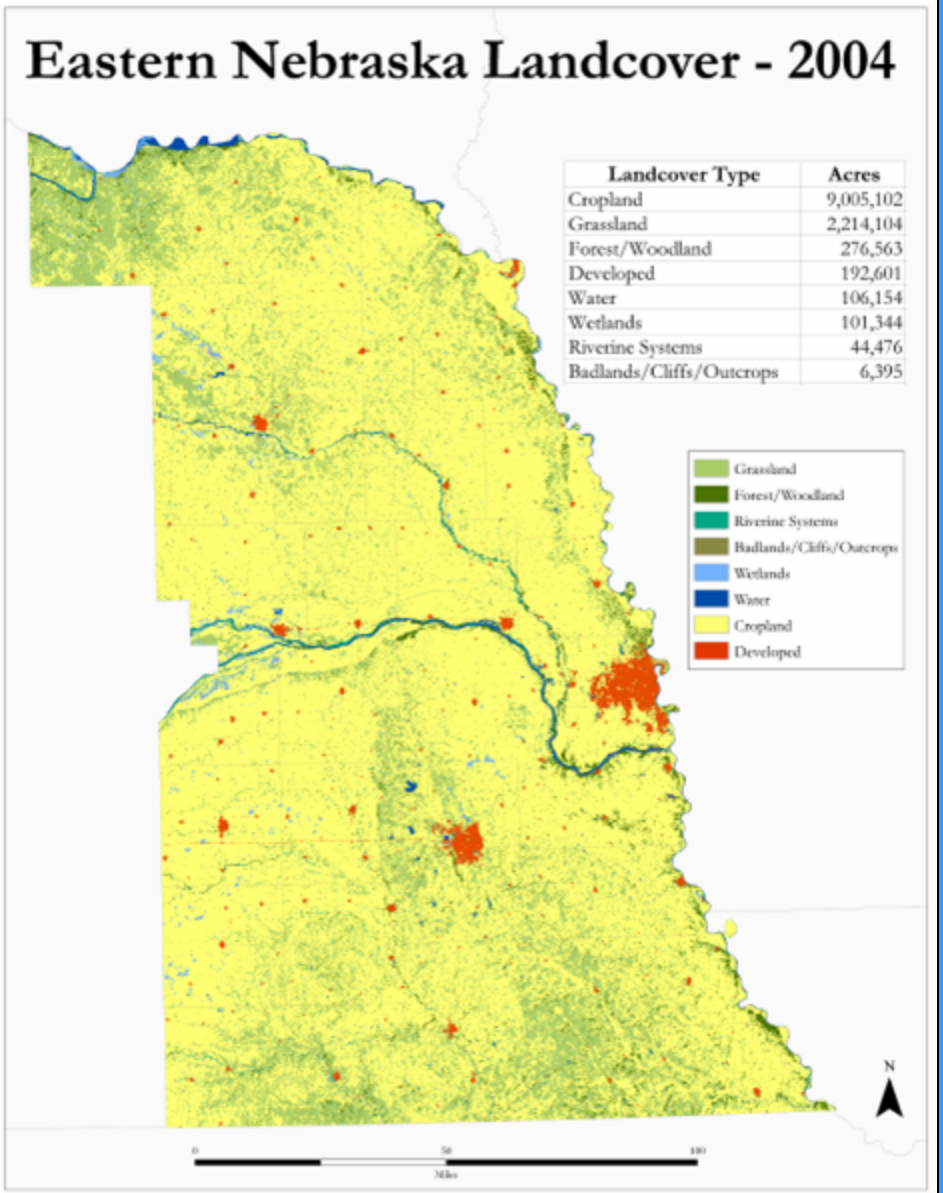


Compare Regional vs. Local Landcover

- Comparison of Landcovers
  - PLJV Landcover
  - Tallgrass Prairie Partnership Landcover
- Landcovers and Modeling for Grassland Birds
  - PLJV
  - Tallgrass Prairie Partnership

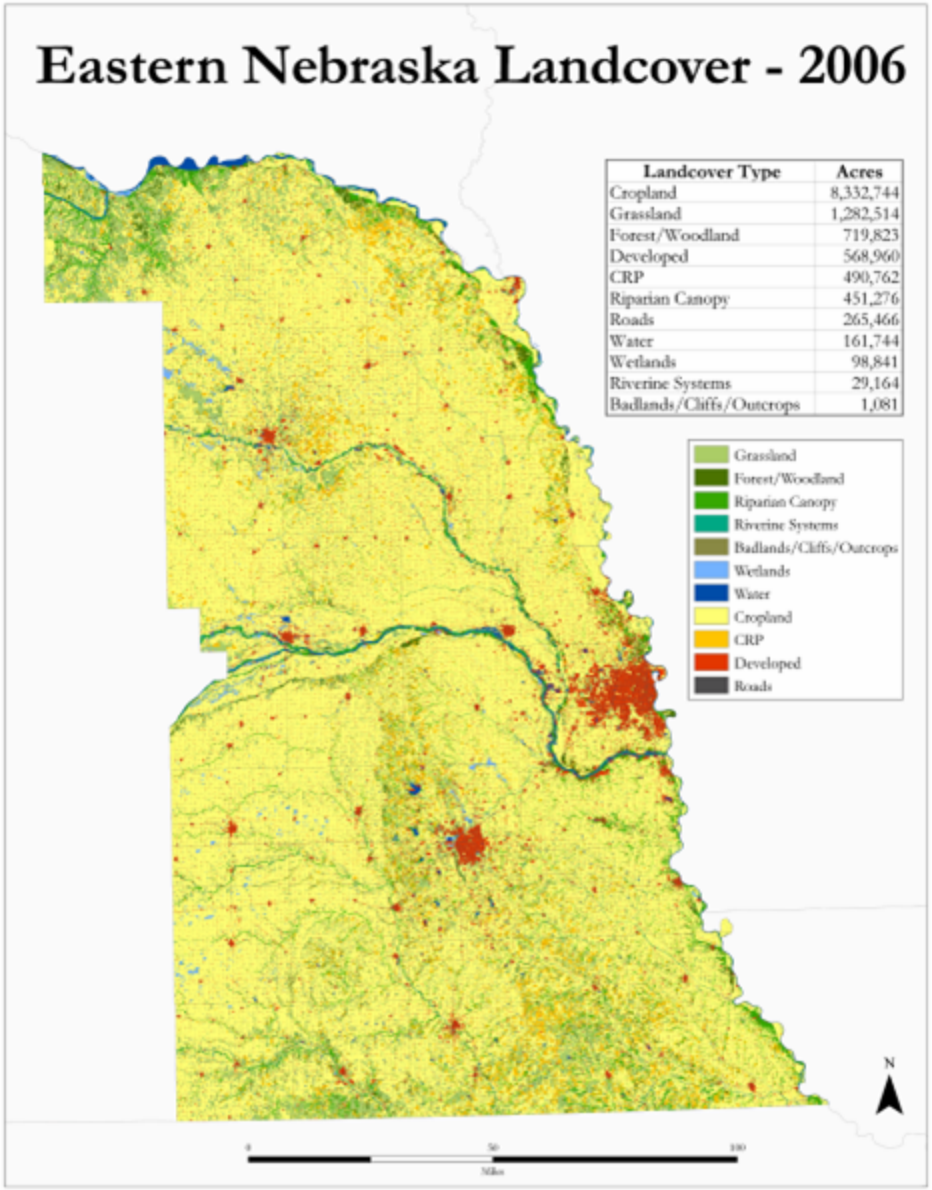
Regional vs. Local Landcover

Eastern Nebraska Landcover - 2004



Landcover Type	Acres
Cropland	9,005,102
Grassland	2,214,104
Forest/Woodland	276,563
Developed	192,601
Water	106,154
Wetlands	101,344
Riverine Systems	44,476
Badlands/Cliffs/Outcrops	6,395

Eastern Nebraska Landcover - 2006



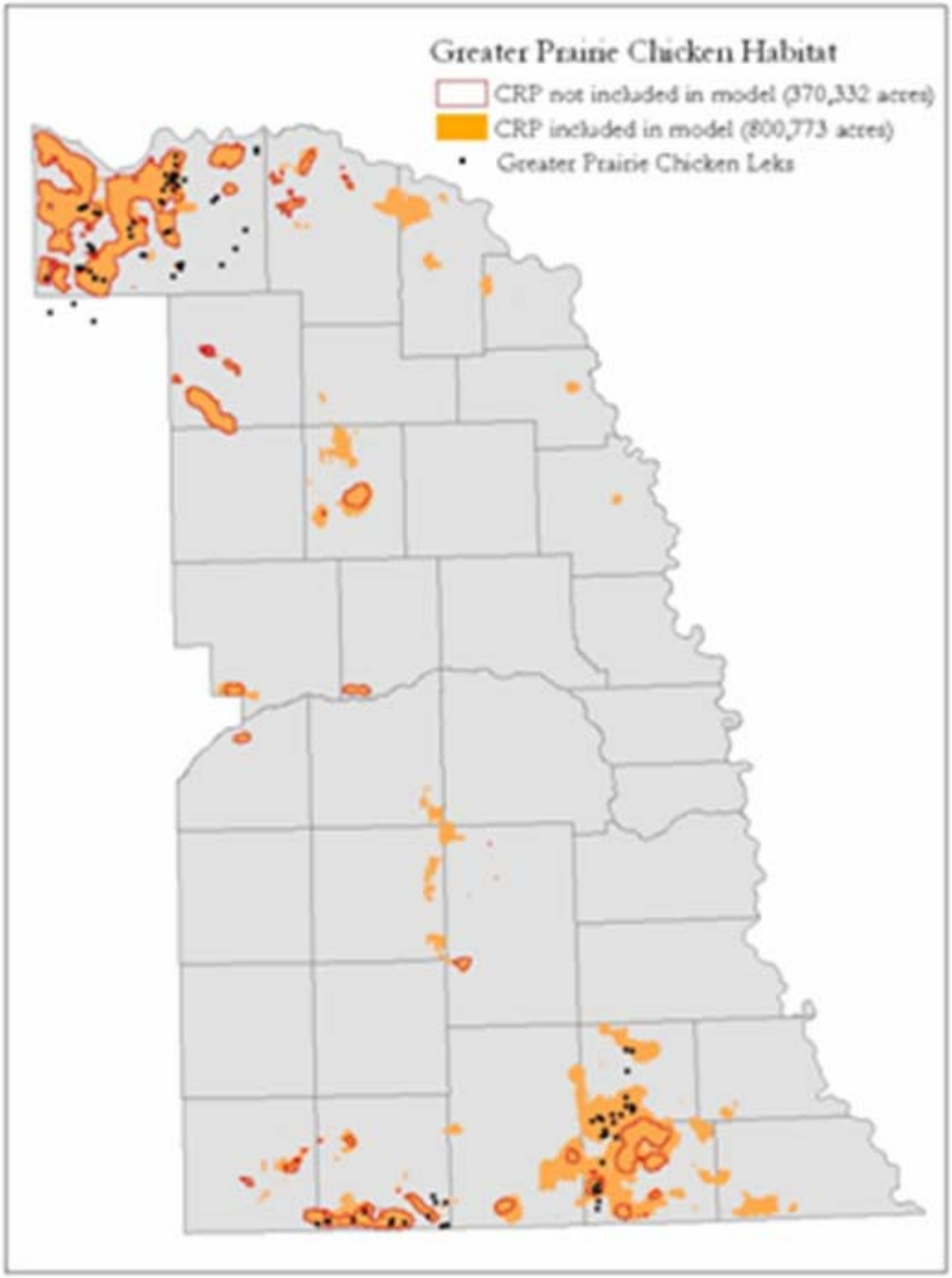
Landcover Type	Acres
Cropland	8,332,744
Grassland	1,282,514
Forest/Woodland	719,823
Developed	568,960
CRP	490,762
Riparian Canopy	451,276
Roads	265,466
Water	161,744
Wetlands	98,841
Riverine Systems	29,164
Badlands/Cliffs/Outcrops	1,081

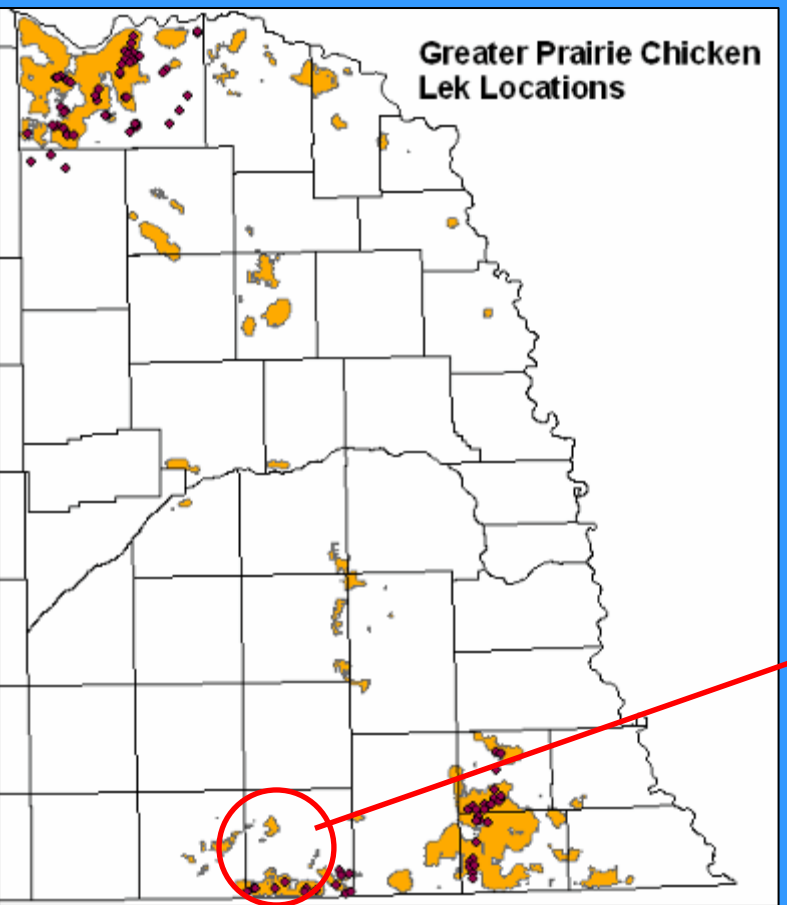
Comparing Landcovers

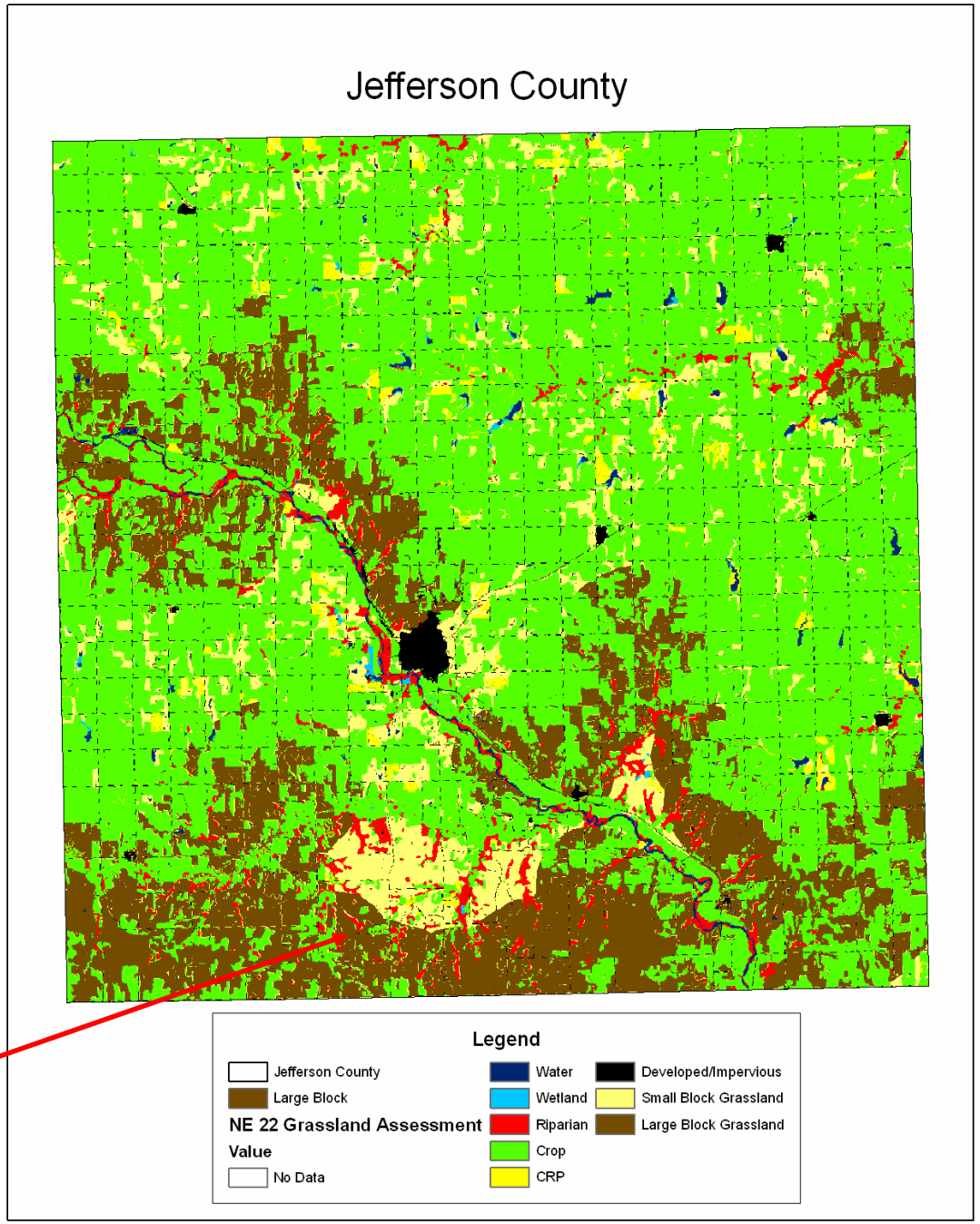
Vegetation Class	(PLJV) 2004	(Tallgrass) 2006	Change
Cropland	9,005,102	8,332,744	-672,358
Grassland	2,214,104	1,282,514	-931,590
CRP	0	490,762	490,762
Wetlands	101,344	98,841	-2,503
Water	106,154	161,744	55,590
Riverine	44,476	29,164	-15,312
Riparian Canopy	0	431,276	431,276
Bare Ground	6,395	1,081	-5,314
Developed	192,601	568,960	376,359
Roads	0	265,466	265,466

Large Block Grassland Modeling

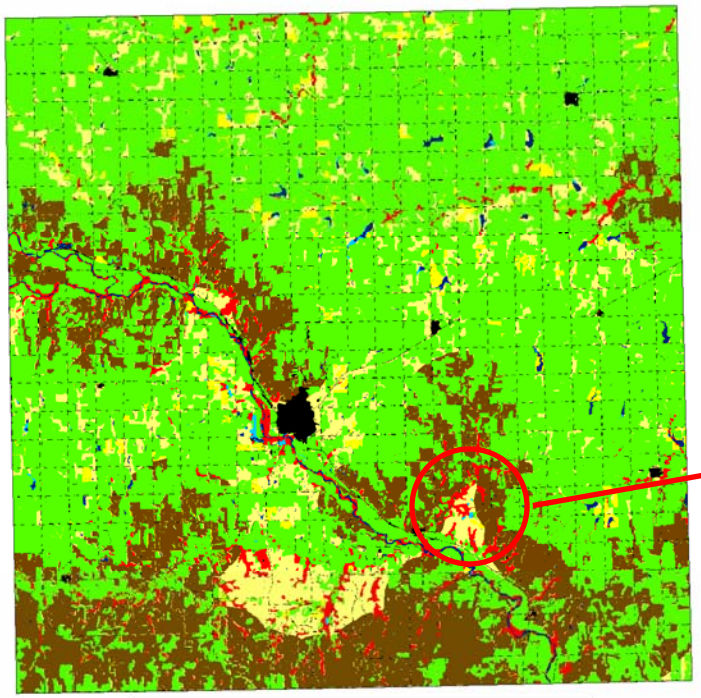
- Similar Large/Small Block Grassland Habitat Modeling can be completed much the same as PLJV demonstrated earlier. But at a much more detailed level. Individual fields for conversion or enhancement can be identified.
- Even at a smaller scale condition is difficult to interpret so assumptions about quality still have to be made. However, at this scale ground surveys can be conducted to narrow this parameter.


Greater Prairie Chicken Habitat
CRP not included in model (370,332 acres)
CRP included in model (800,773 acres)
Greater Prairie Chicken Leks

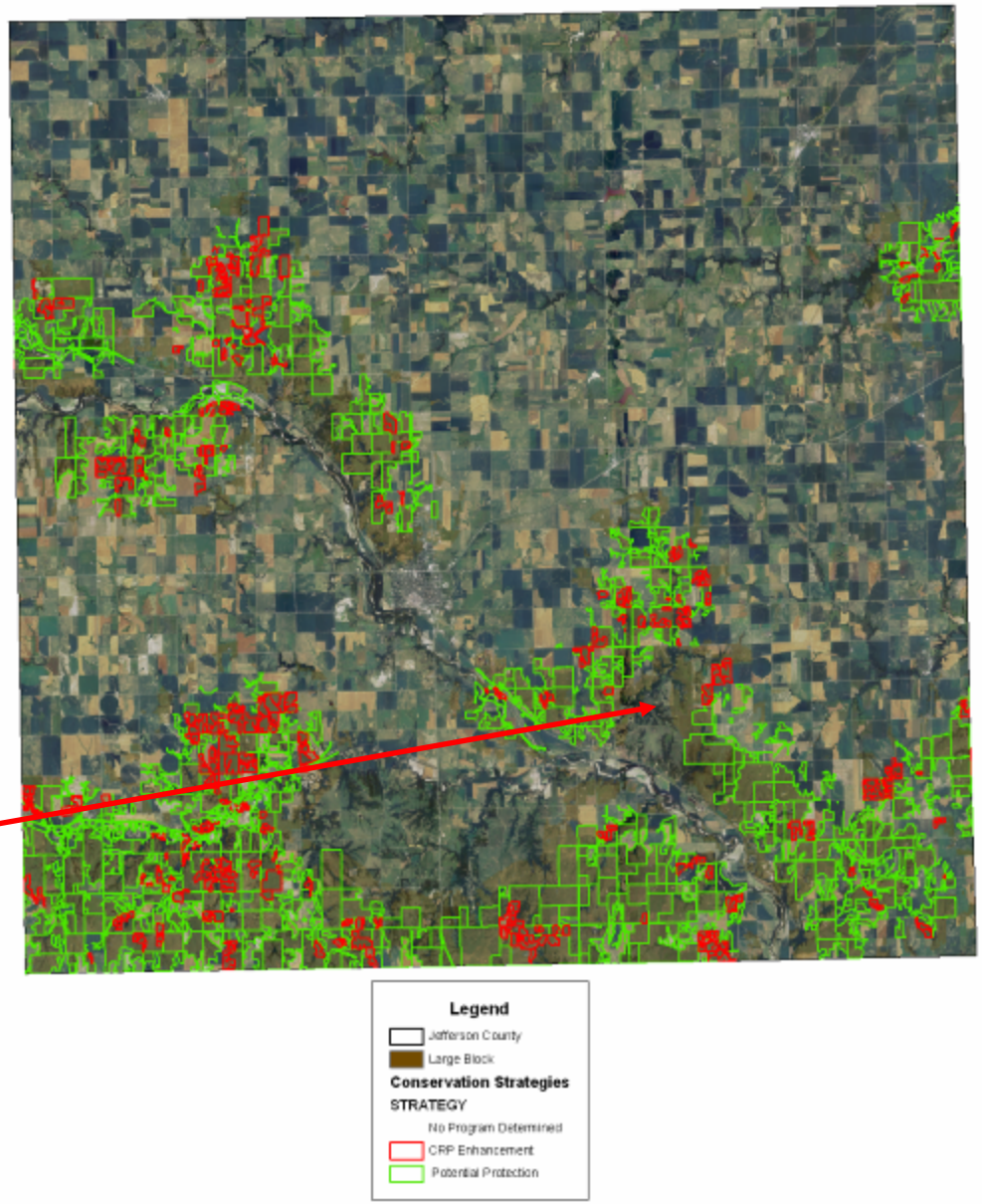

Greater Prairie Chicken
Lek Locations


Jefferson County
Legend
Jefferson County
Large Block
NE 22 Grassland Assessment
Value
No Data
Water
Wetland
Riparian
Crop
CRP
Developed/Impervious
Small Block Grassland
Large Block Grassland

Jefferson County



Conservation Strategies



RWB Wetland Habitat Monitoring

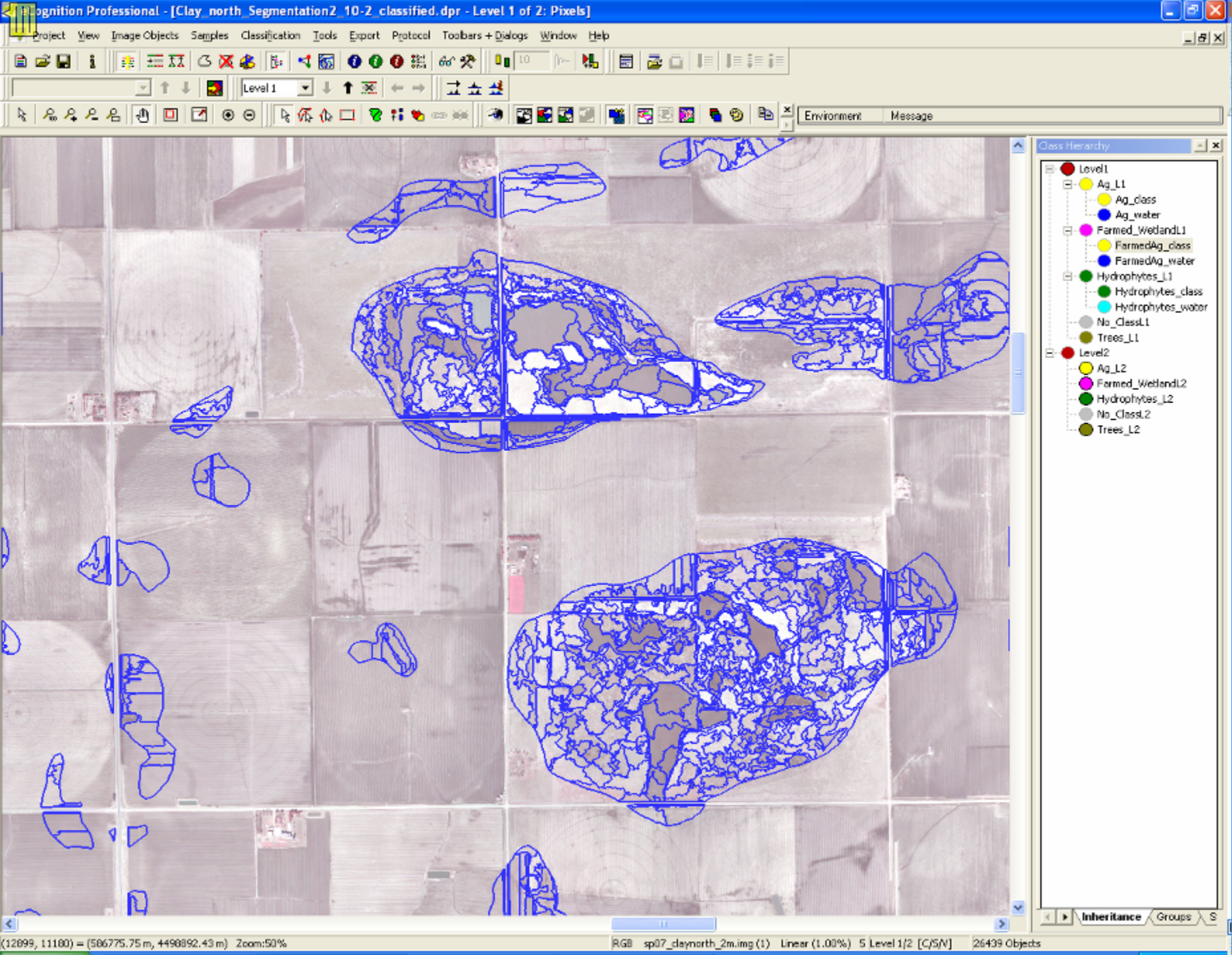
- RWB Landcover – Significant first step
- Wetland LU/LC – What are the conditions in the wetlands?
  - Habitat Survey – which wetlands still exist & at what level?
    - Inventory
    - Trends
  - Wetland Vegetation Mapping – what condition are wetlands in?
    - Management Strategies
    - Protection/Restoration Strategies
    - Waterfowl Energetics Calculations

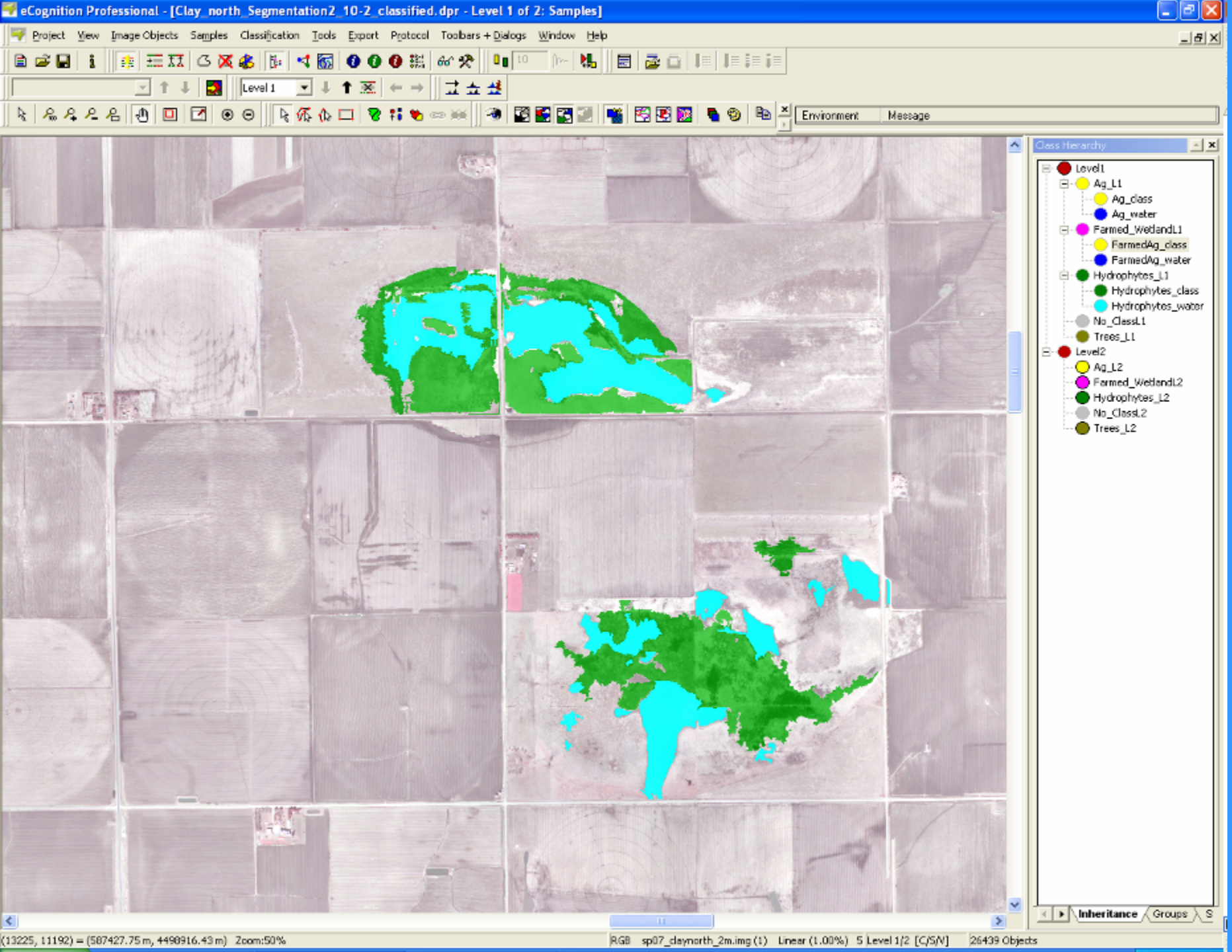
Landcover + CIR Imagery + eCognition

- Our ability to analyze the landscape is magnified when combining the landcover with powerful image processing software.
  - Landcover is used to mask cover types during processing to avoid classification confusion
- Object-oriented (vector) vs. raster image classification software
  - Combination of landcover and eCognition has the ability to tease out detailed landscape information about individual land parcels
  - Raster classification is faster, but less detailed

Detailed Landcover Improves Wetland Mapping/Bird Modeling

- **Annual Habitat Survey**
- Wetland Prioritization Models
- Wetland Vegetation Mapping
- Bird Habitat Models


Project View Image Objects Samples Classification Tools Export Protocol Toolbars + Dialogs Window Help
Level 1
Environment Message
Class Hierarchy
Level1
Ag_L1
Ag_class
Ag_water
Farmed_WetlandL1
FarmedAg_class
FarmedAg_water
Hydrophytes_L1
Hydrophytes_class
Hydrophytes_water
No_ClassL1
Trees_L1
Level2
Ag_L2
Farmed_WetlandL2
Hydrophytes_L2
No_ClassL2
Trees_L2
Inheritance
Groups
(12099, 11180) = (586775.75 m, 4498892.43 m) Zoom:50%
RGB sp07_claynorth_2m.img (1) Linear (1.00%) 5 Level 1/2 [C/S/N]
26439 Objects


eCognition Professional - [Clay_north_Segmentation2_10-2_classified.dpr - Level 1 of 2: Samples]
Project View Image Objects Samples Classification Tools Export Protocol Toolbars + Dialogs Window Help
Level 1
Environment Message
Class Hierarchy
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Ag_L1
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Ag_water
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FarmedAg_class
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Hydrophytes_L1
Hydrophytes_class
Hydrophytes_water
No_ClassL1
Trees_L1
Level2
Ag_L2
Farmed_WetlandL2
Hydrophytes_L2
No_ClassL2
Trees_L2
Inheritance
Groups
(13225, 11192) = (587427.75 m, 4498916.43 m) Zoom:50%
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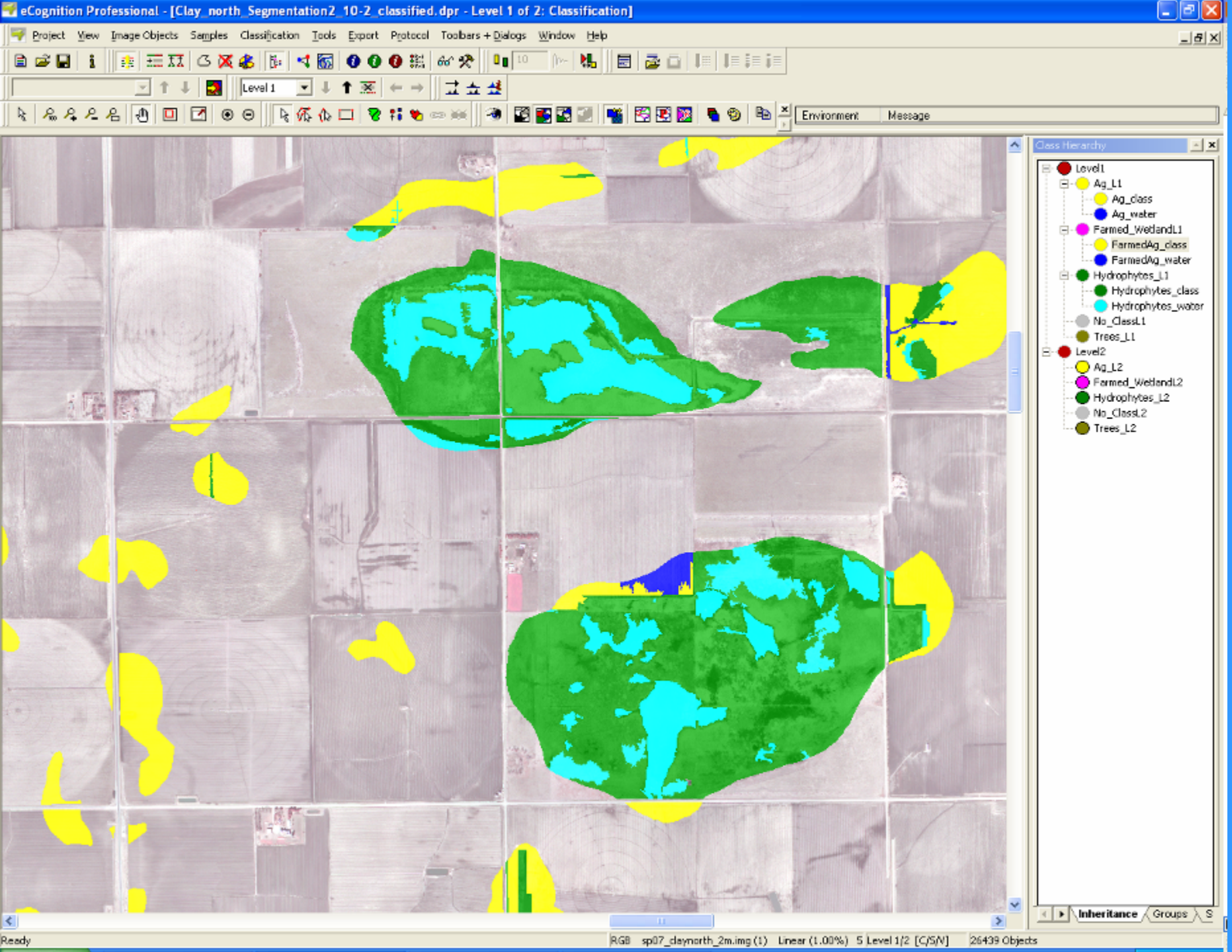
26439 Objects


eCognition Professional - [Clay_north_Segmentation2_10-2_classified.dpr - Level 1 of 2: Classification]
Project View Image Objects Samples Classification Tools Export Protocol Toolbars + Dialogs Window Help
Level 1
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Ag_class
Ag_water
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FarmedAg_class
FarmedAg_water
Hydrophytes_L1
Hydrophytes_class
Hydrophytes_water
No_ClassL1
Trees_L1
Level2
Ag_L2
Farmed_WetlandL2
Hydrophytes_L2
No_ClassL2
Trees_L2
Inheritance
Groups
Ready
RGB sp07_claynorth_2m.img (1) Linear (1.00%) 5 Level 1/2 [C/S/N]
26439 Objects

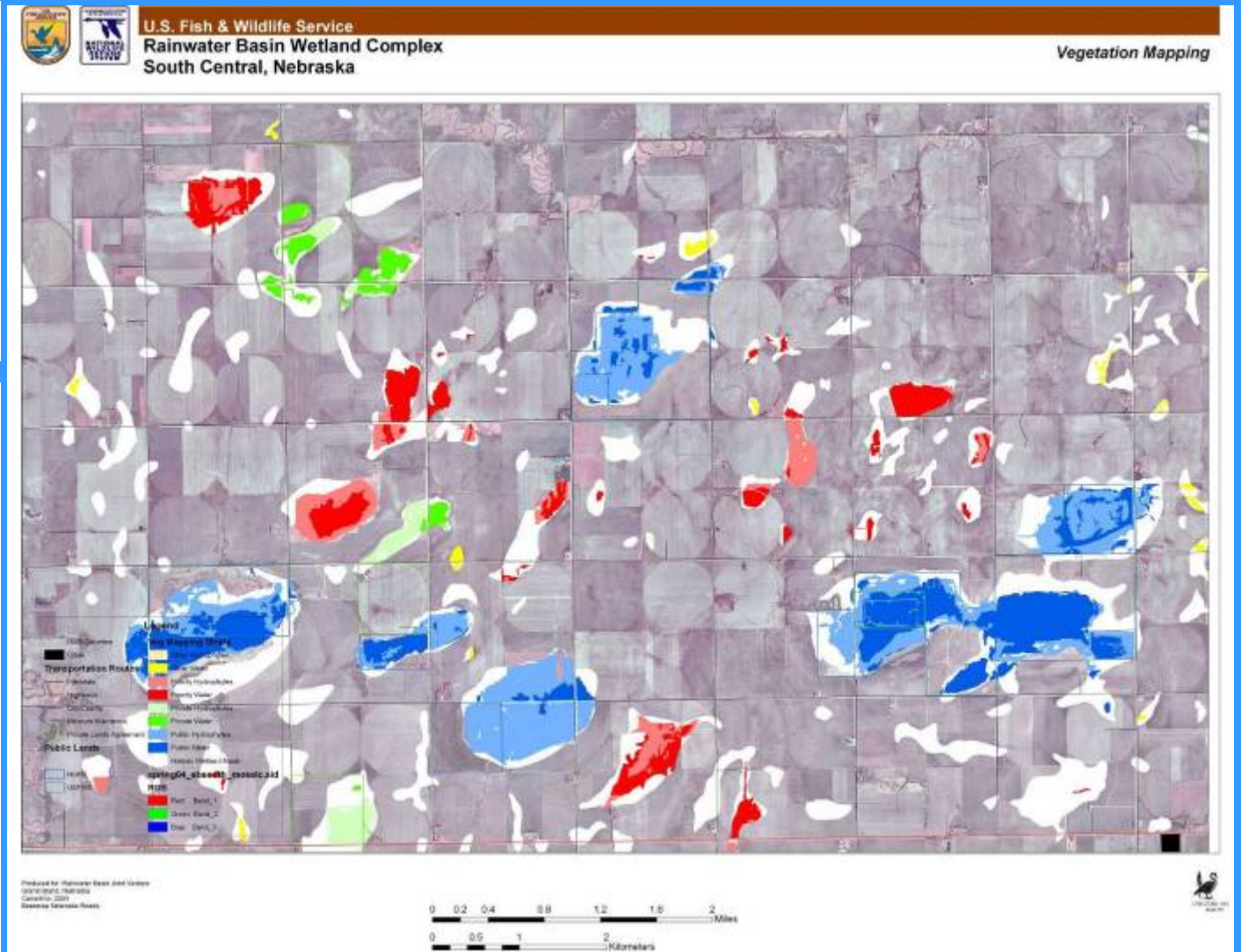
Annual Waterfowl Habitat Survey

- Categories
  - Hydrophytes
  - Stressed Ag
  - Water

- Publicly-Owned
- Easements
- Priority Private
- Non-Priority Private

Dark = Water

Light = Hydrophytes
Stressed Ag



Detailed Landcover Improves Wetland Mapping/Bird Modeling

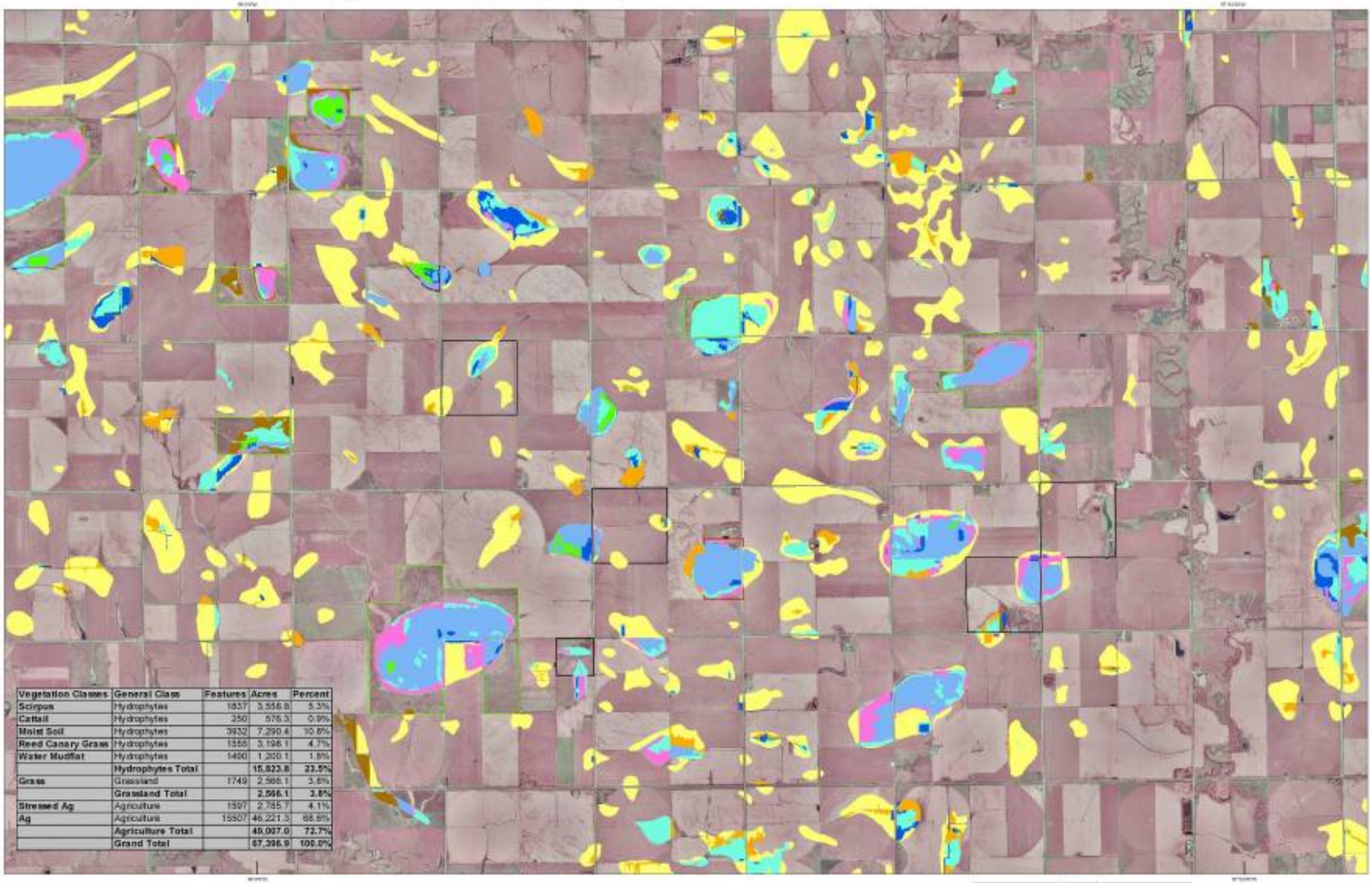
- Annual Habitat Survey
- Wetland Prioritization Model
- **Wetland Vegetation Mapping**
- Bird Habitat Models

U.S. Fish & Wildlife Service

Rainwater Basin Wetland Complex

Clay, Fillmore, Nuckolls, Thayer Counties, South-Central Nebraska

Wetland Vegetation



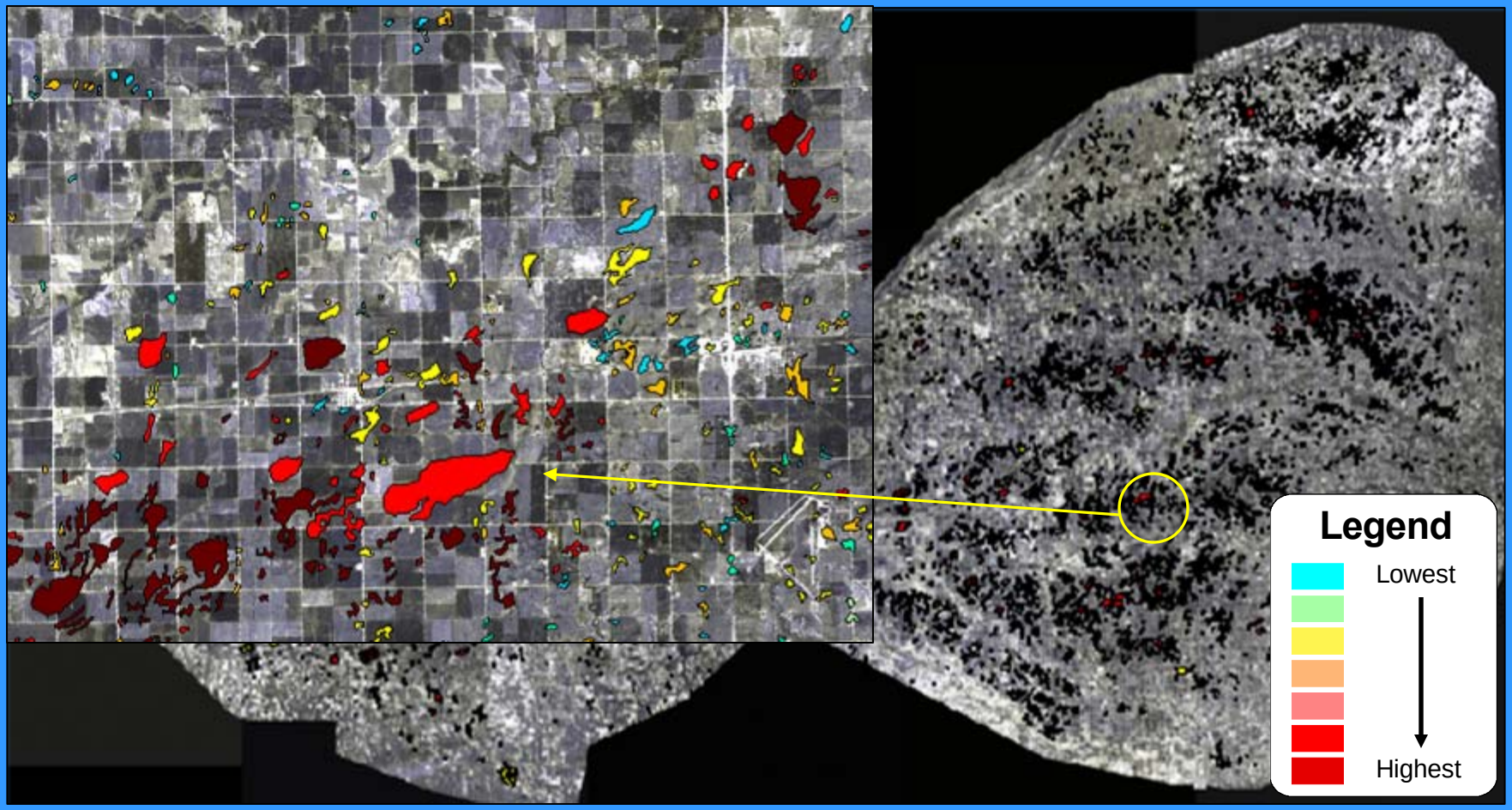
Vegetation Classes	General Class	Features	Acres	Percent
Scirpus	Hydrophytes	1837	3,556.8	5.3%
Cattail	Hydrophytes	250	576.3	0.9%
Moist Soil	Hydrophytes	3932	7,290.4	10.8%
Reed Canary Grass	Hydrophytes	1355	3,196.1	4.7%
Water Mudflat	Hydrophytes	1460	1,200.1	1.8%
	Hydrophytes Total		**15,823.8**	**23.5%**
Grass	Grassland	1749	2,566.1	3.8%
	Grassland Total		**2,566.1**	**3.8%**
Stressed Ag	Agriculture	1597	2,785.7	4.1%
Ag	Agriculture	15907	46,221.3	68.6%
	Agriculture Total		**49,007.0**	**72.7%**
	Grand Total		**67,396.9**	**100.0%**

Produced for Rainwater Basin Joint Venture
Grand Island, Nebraska
Current to: 2004
Basemap (Data): 2004 CIR Imagery

Legend

- FWS WPAs
- NGPC WMAs
- Private Lands Agreements
- Scirpus
- Cattail
- Moist Soil
- Reed Canary Grass
- Grass
- Water Mudflat
- Stressed Ag
- Ag

Priority Wetlands



Setting Wetland Habitat Objectives for the Rainwater Basin

- Identify Current Conditions
  - Annual Habitat Survey, Wetland Vegetation Map
- Set Population Objectives
  - Duck-Use Days
- Identify Habitat Deficiencies
- Set Habitat Objectives
  - Can calculate benefit from WRP, CRP, etc
  - Wildlife CEAP
- Prioritize and Target Habitat Restoration and Management

Great Plains GIS Partnership

United States Department of Agriculture
Farm Service Agency

United States Department of Agriculture
NRCS Natural Resources Conservation Service