Eco-Logical Approach to Planning for the East-West Gateway

May 12 & 14, 2010

David Diamond, Diane True, Lee Elliott, Clayton Blodgett, Gust Annis, Kim Traxler, and Caroline Twenter

Contact: diamondd@missouri.edu

Presentation Outline

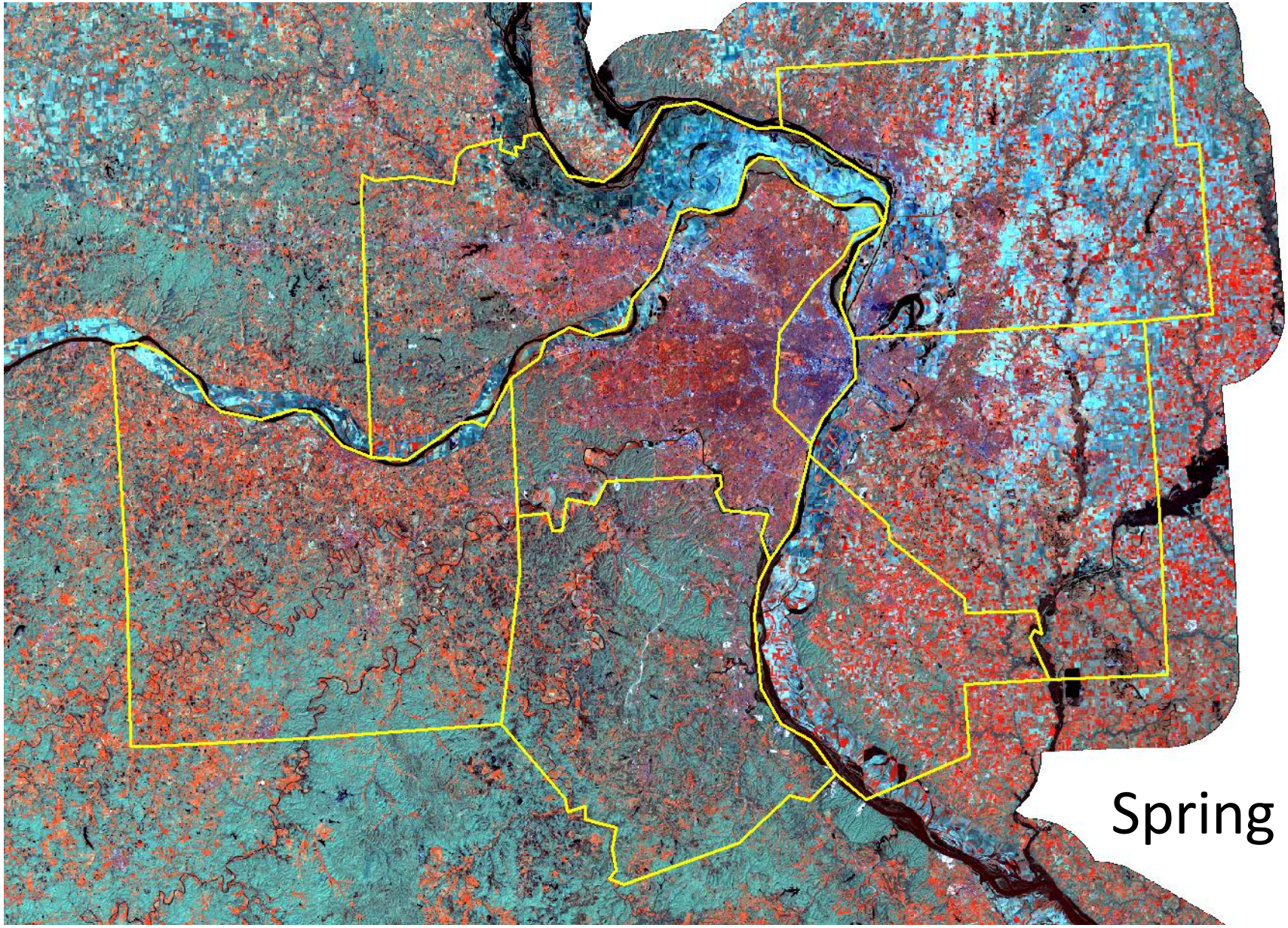
- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

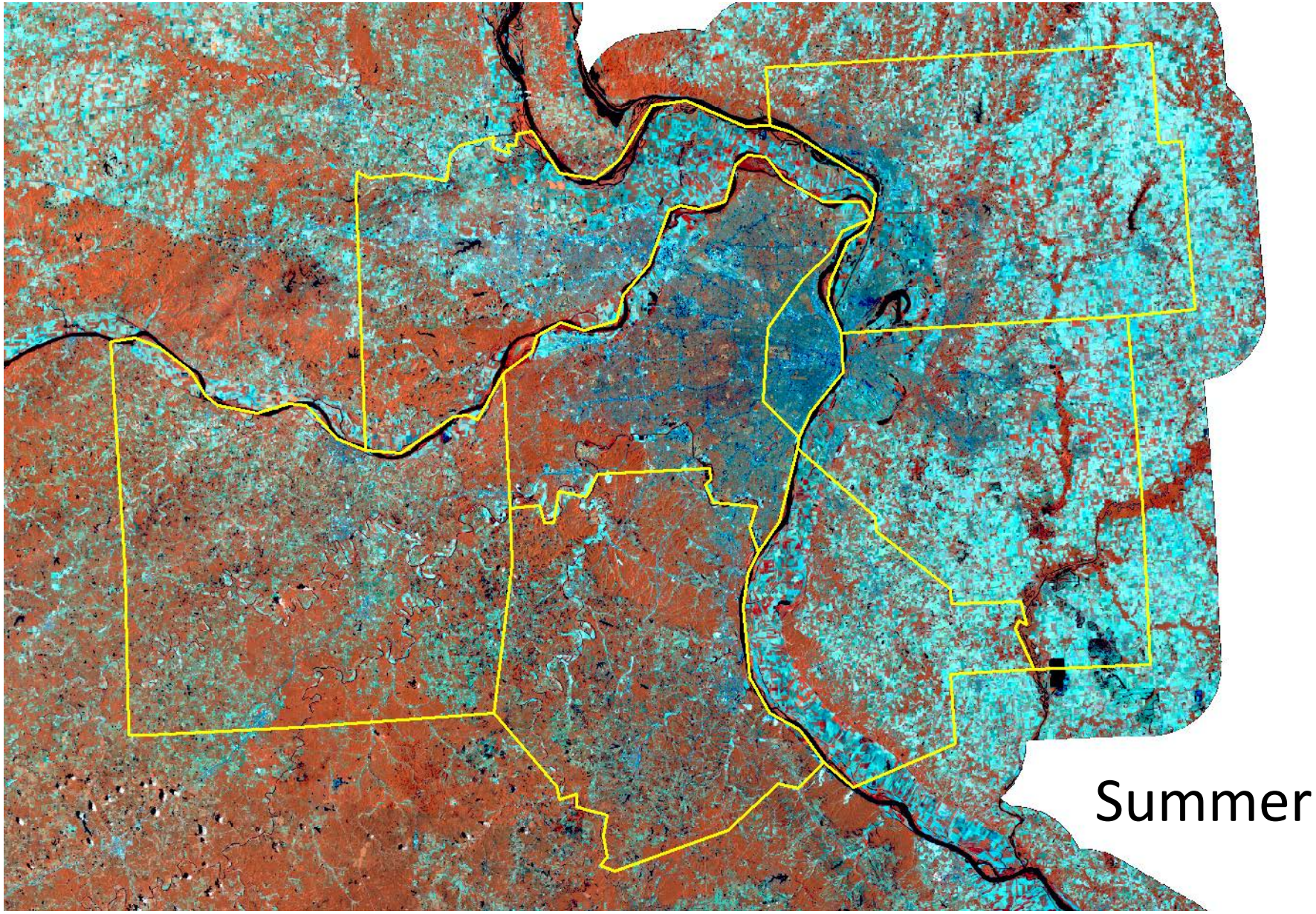
Presentation Outline

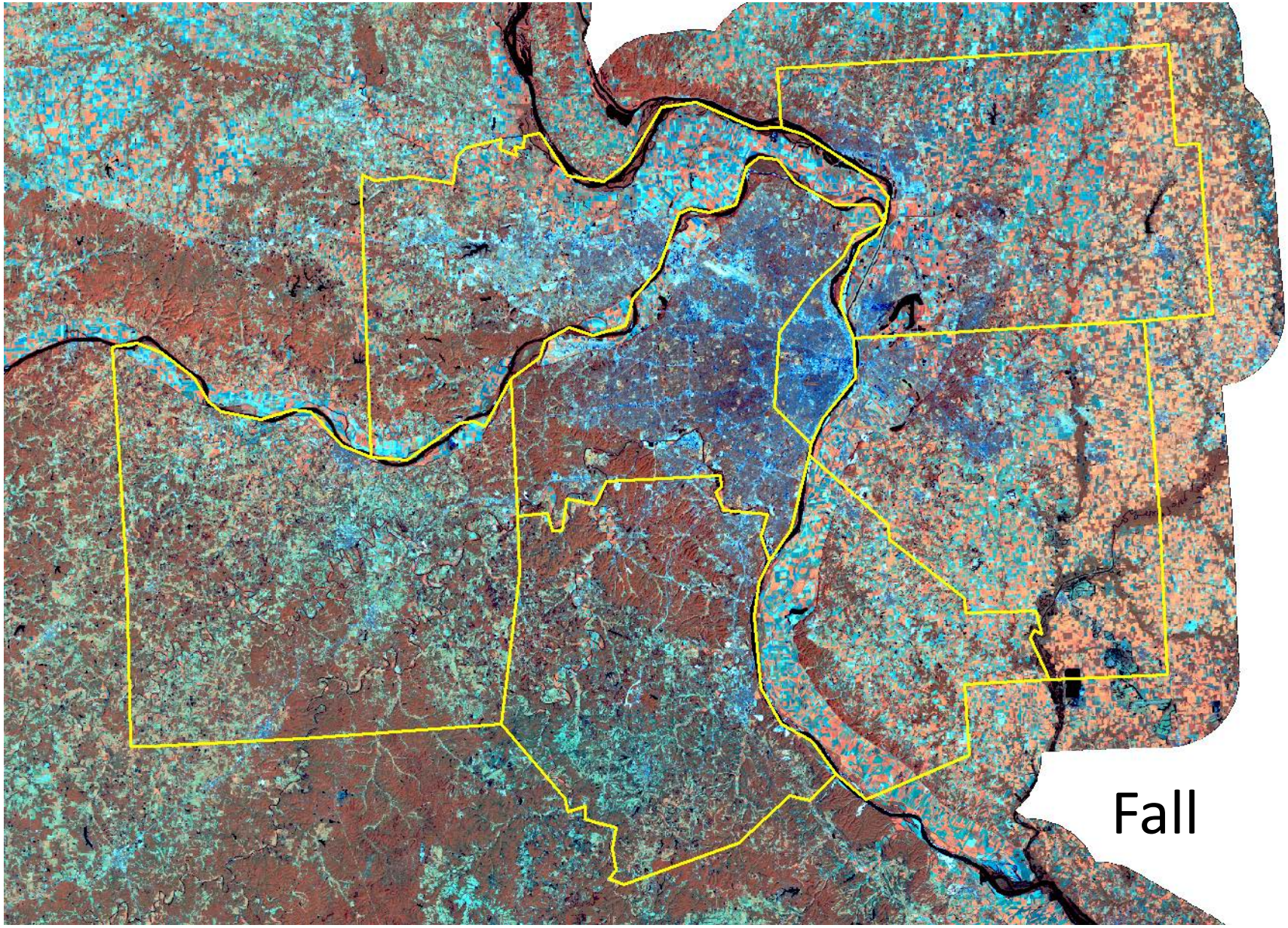
- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

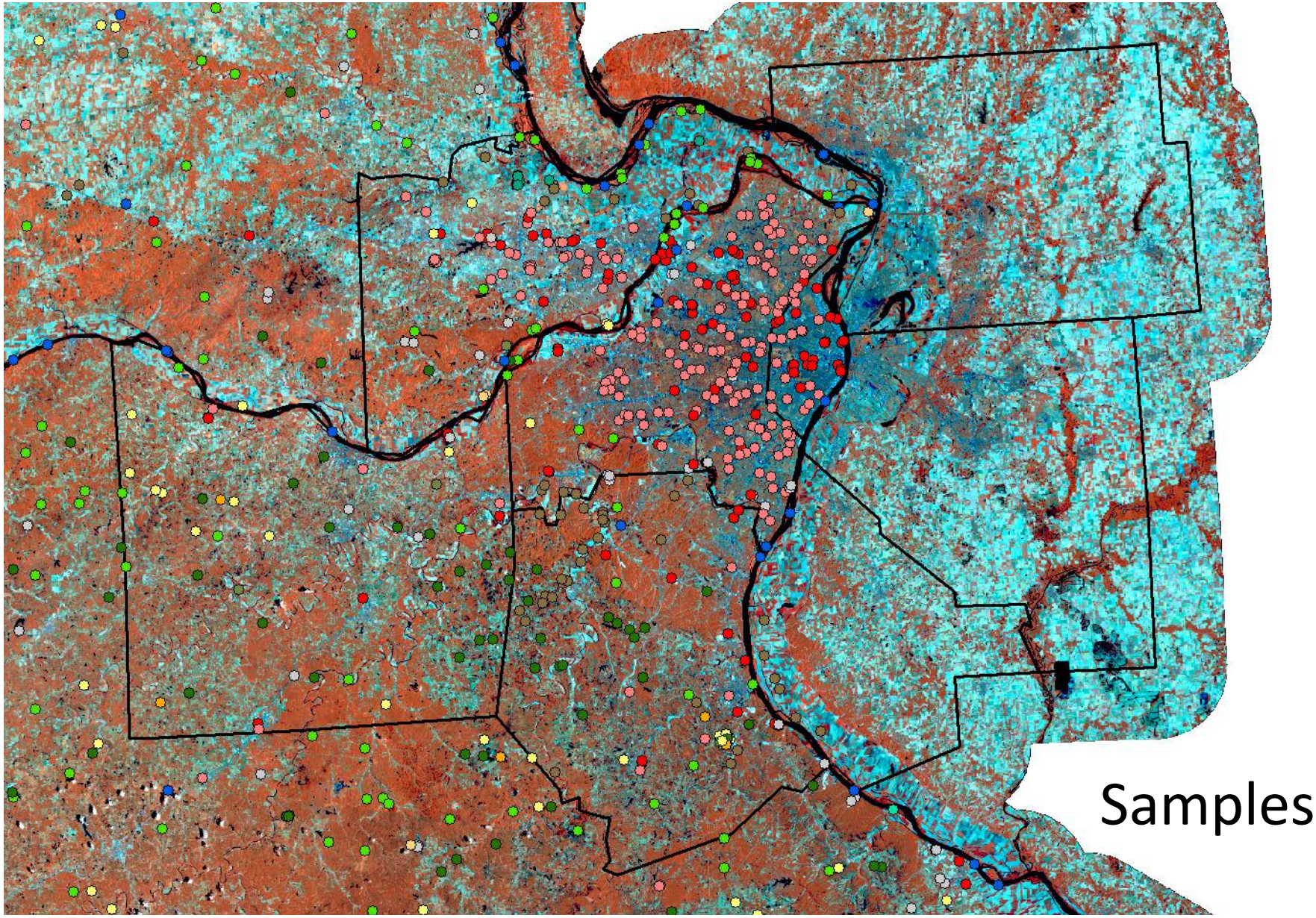
Land cover data from satellite imagery

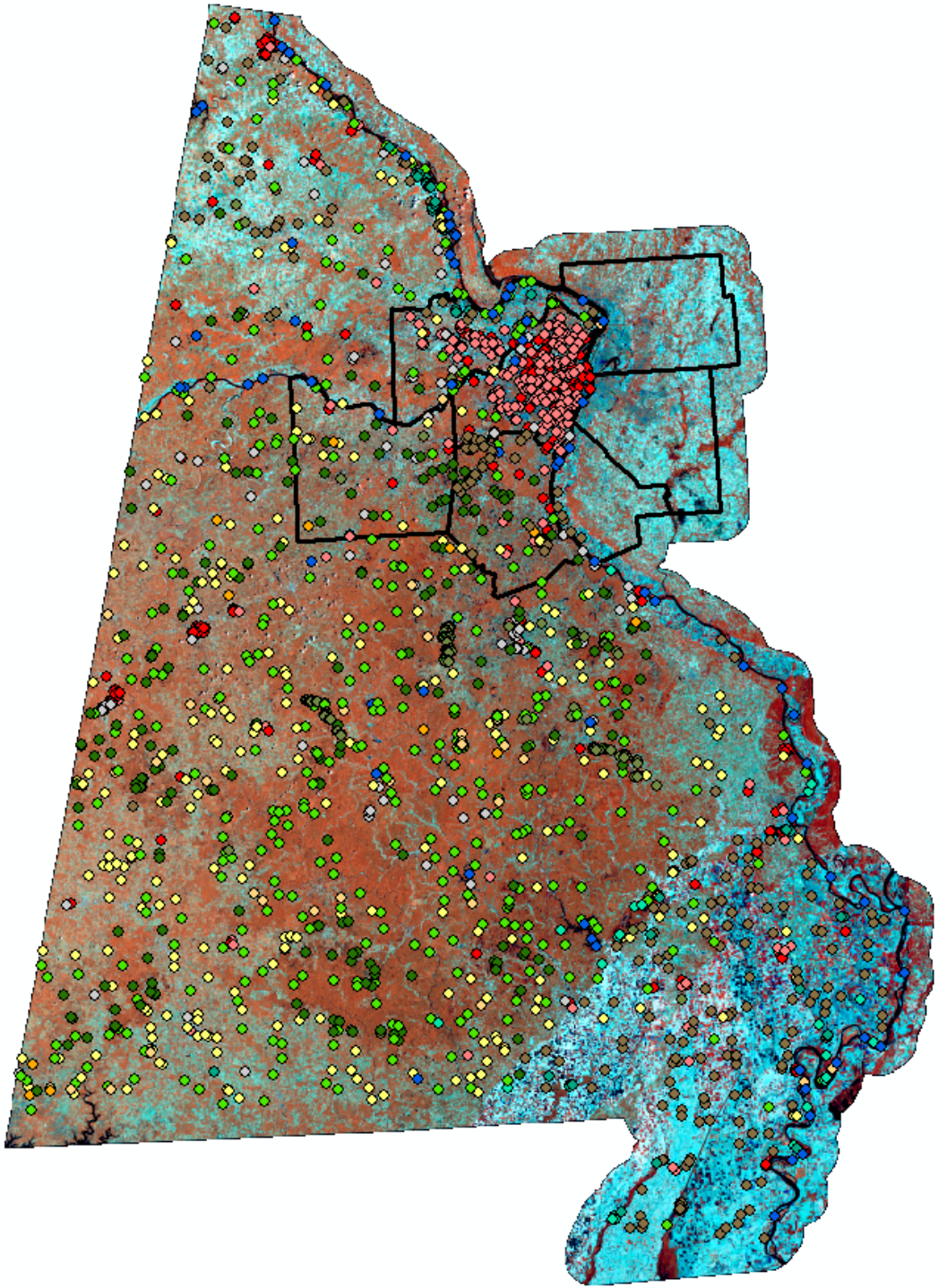
- Three date (spring, summer, fall)
- Abiotic data (slope, aspect, landscape position, solar insolation, % canopy, % impervious, cropland, alluvium)
- Sample points from previous landcover
- Verified with NAIP imagery
- See5 classifier


Spring


Summer


Fall


Samples

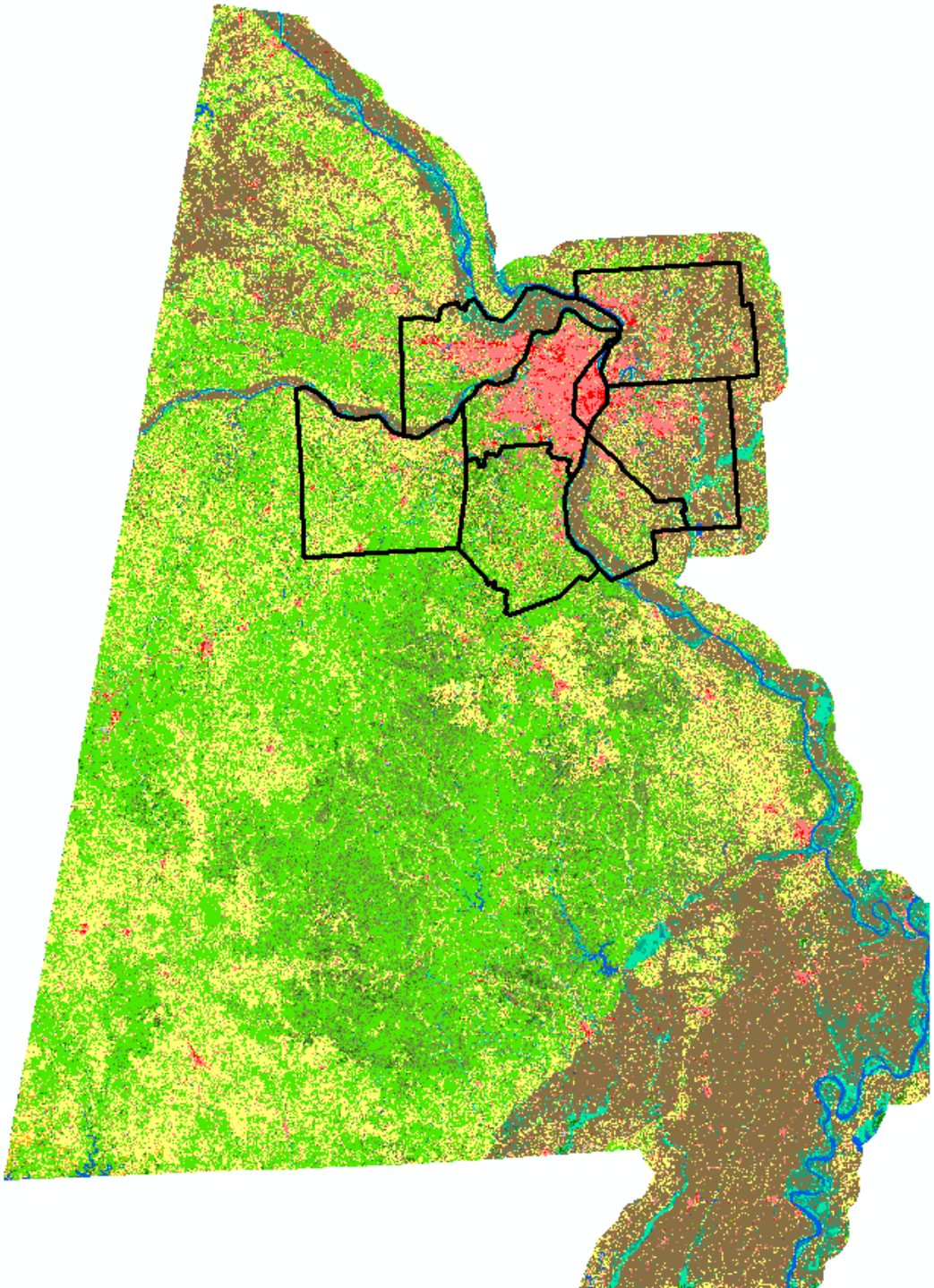


EAST-WEST GATEWAY
Council of Governments

MoDOT

MoRAP

Working Regionally

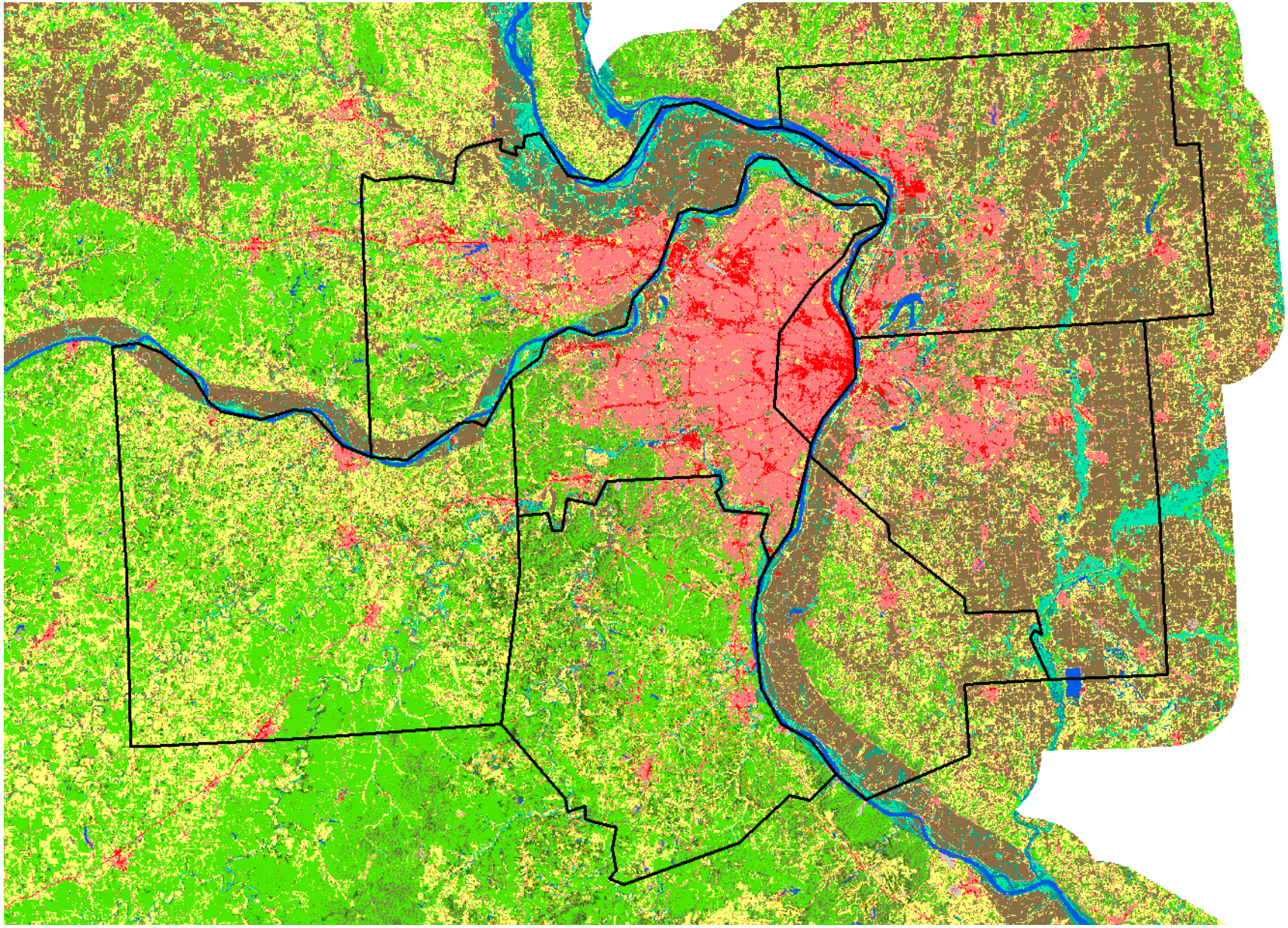


EAST-WEST GATEWAY
Council of Governments

MoDOT

MoRAP

Working Regionally



Presentation Outline

- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

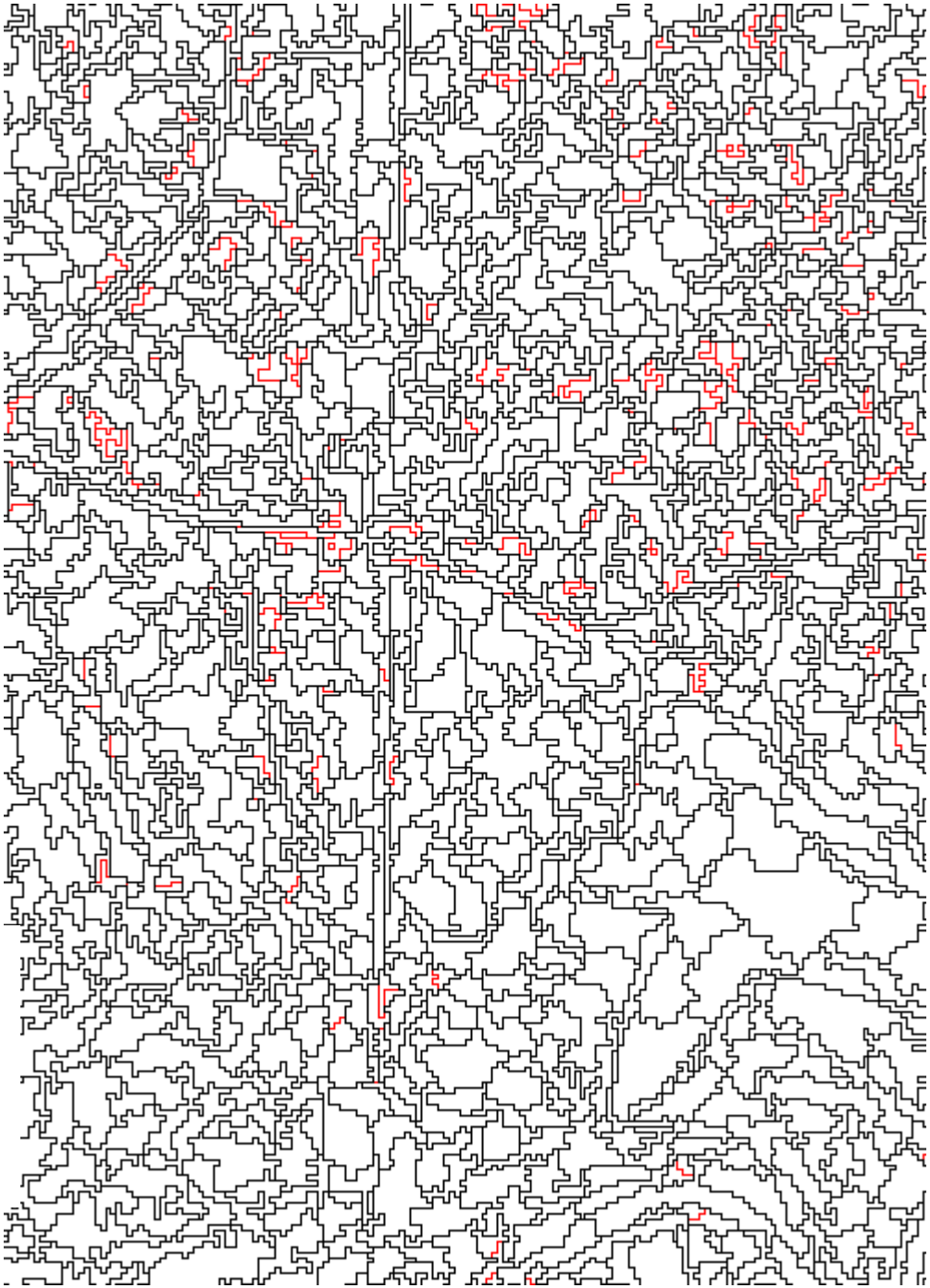
Object creation from NAIP

- 1 meter NAIP resampled to 6 meters
- Leaf-on and leaf-off merged
- eCognition Developer
- Scale factor of 15
- Smallest objects “Eliminated” in ArcInfo

DEFINIENS
Understanding Images

ArcGIS
GIS by ESRI

Object Sizes



scale 15

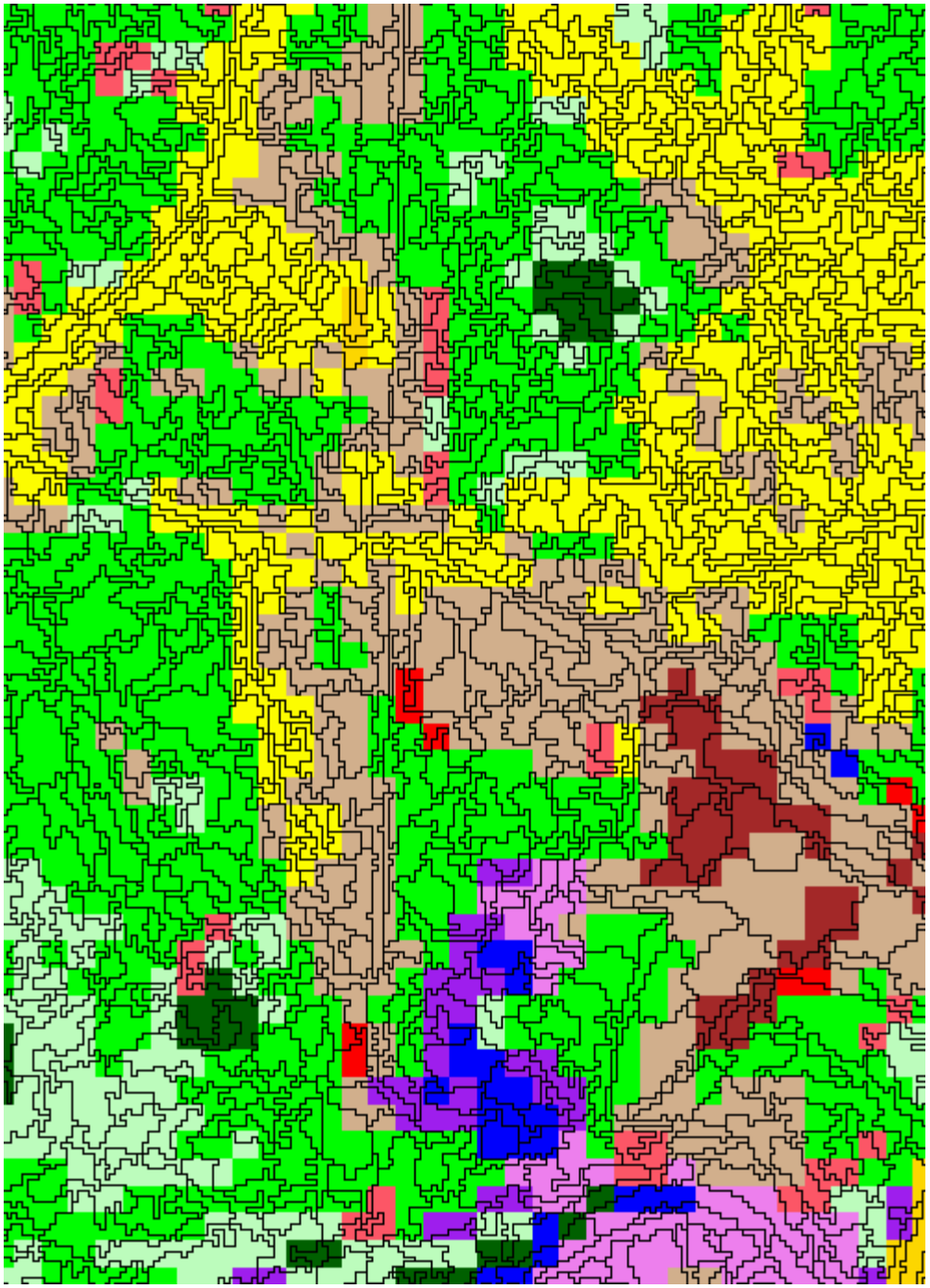
scale 10

Scale 15

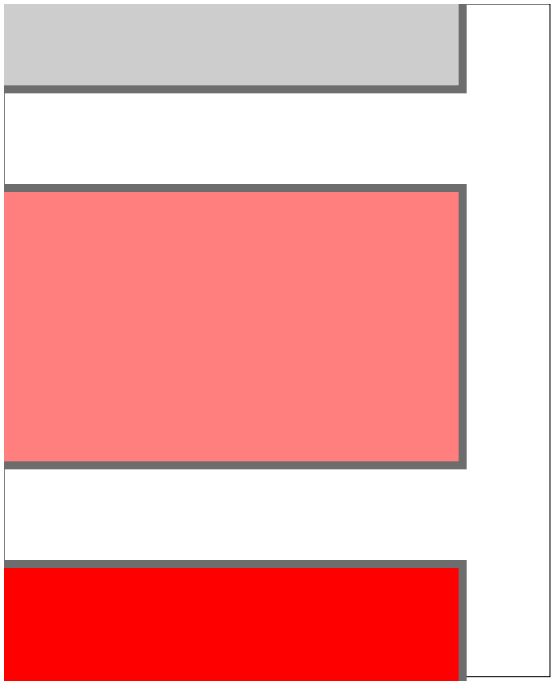
Area < 900 square meters removed

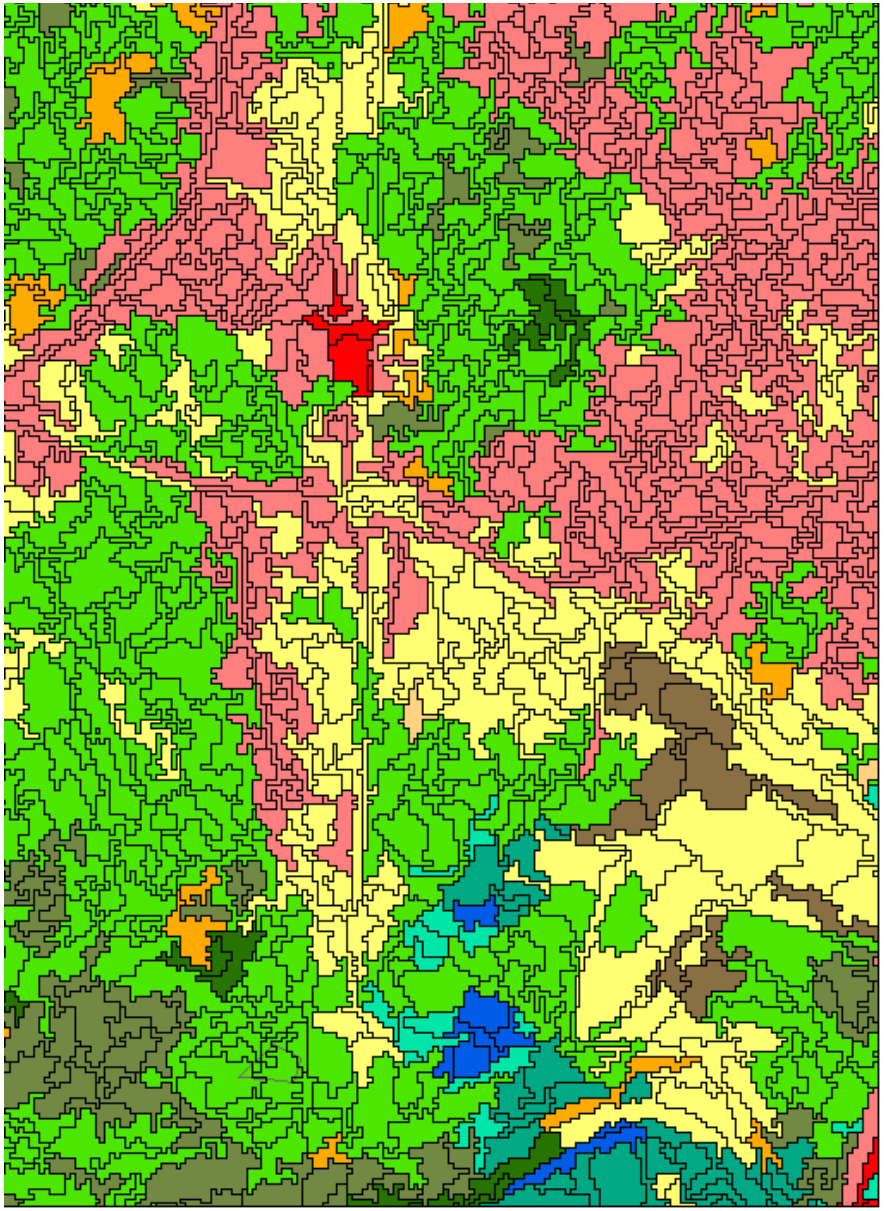
Image Objects

Original LULC

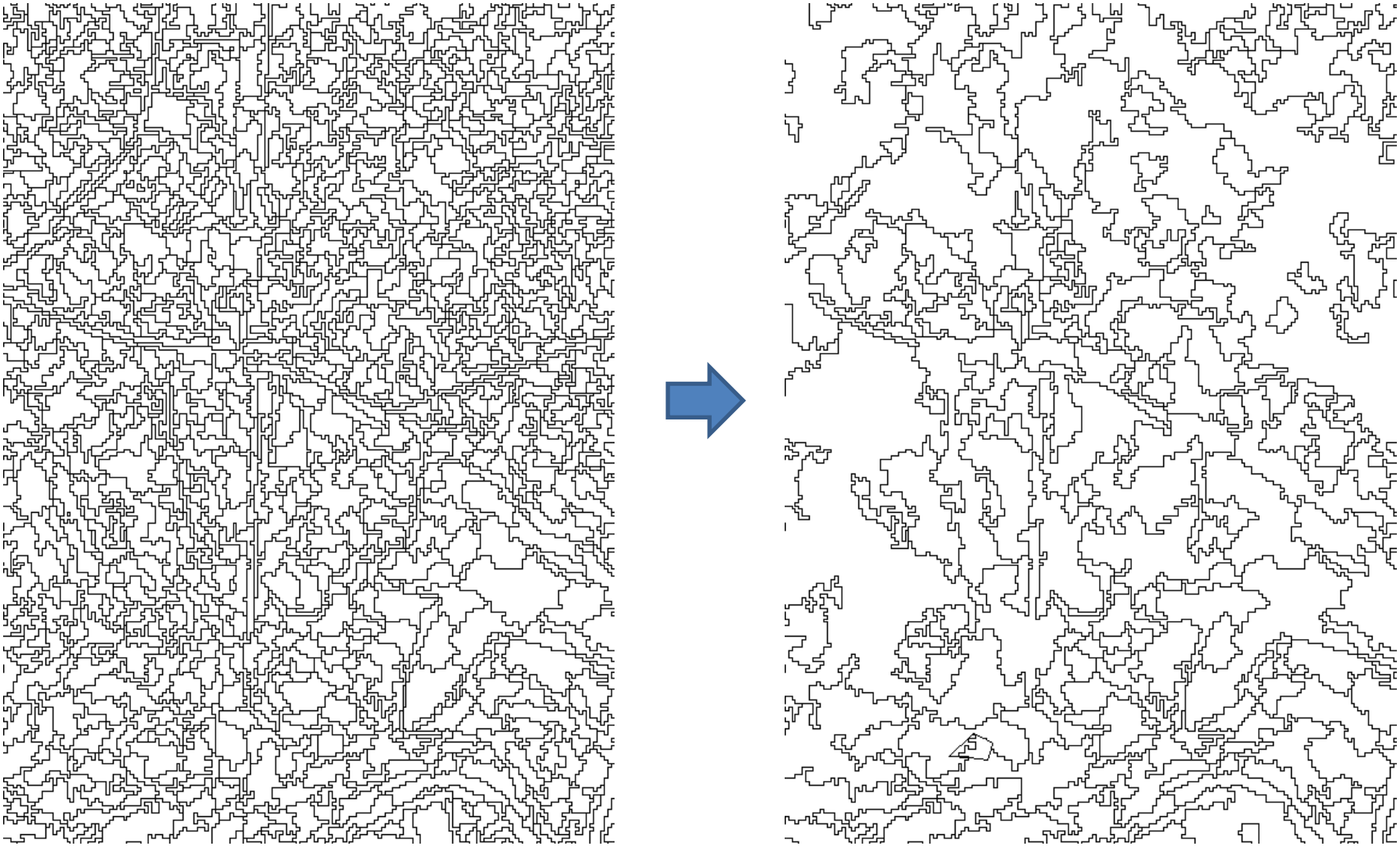


Current Vegetation with Objects

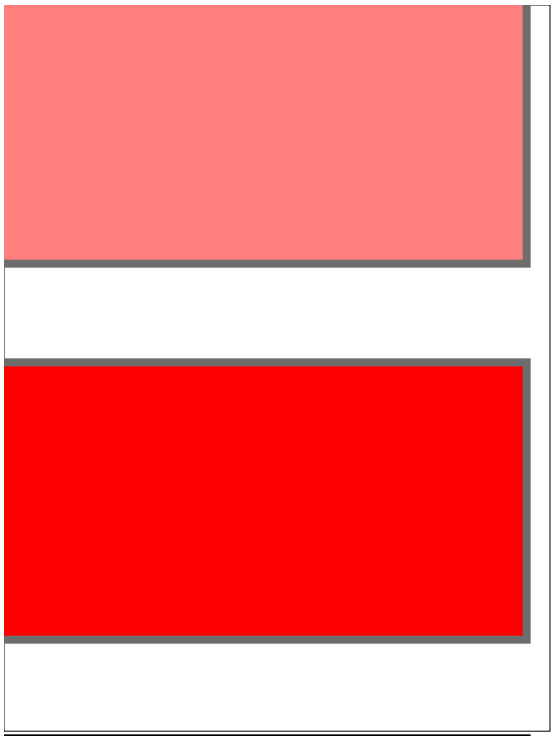


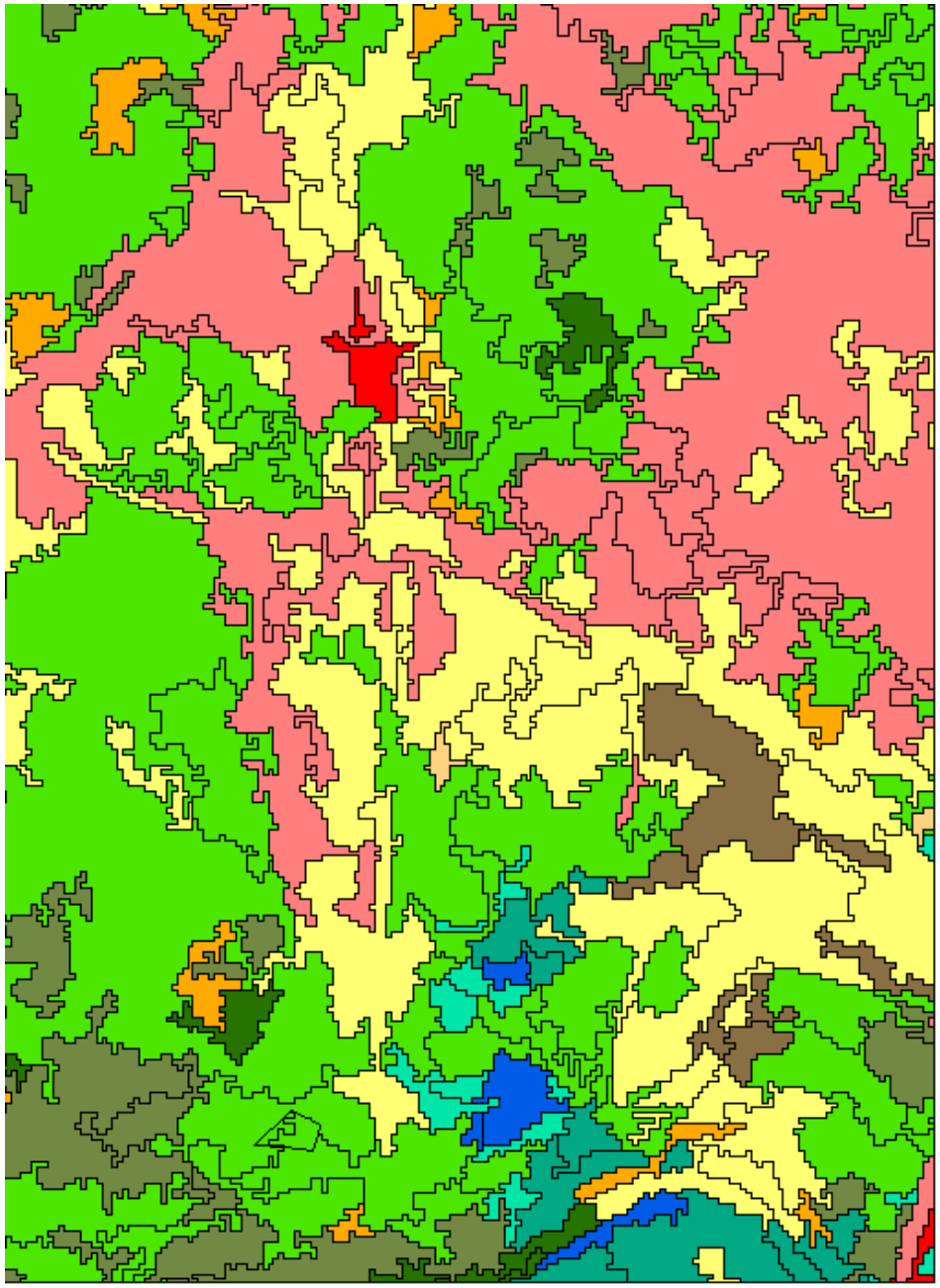


Final Objects

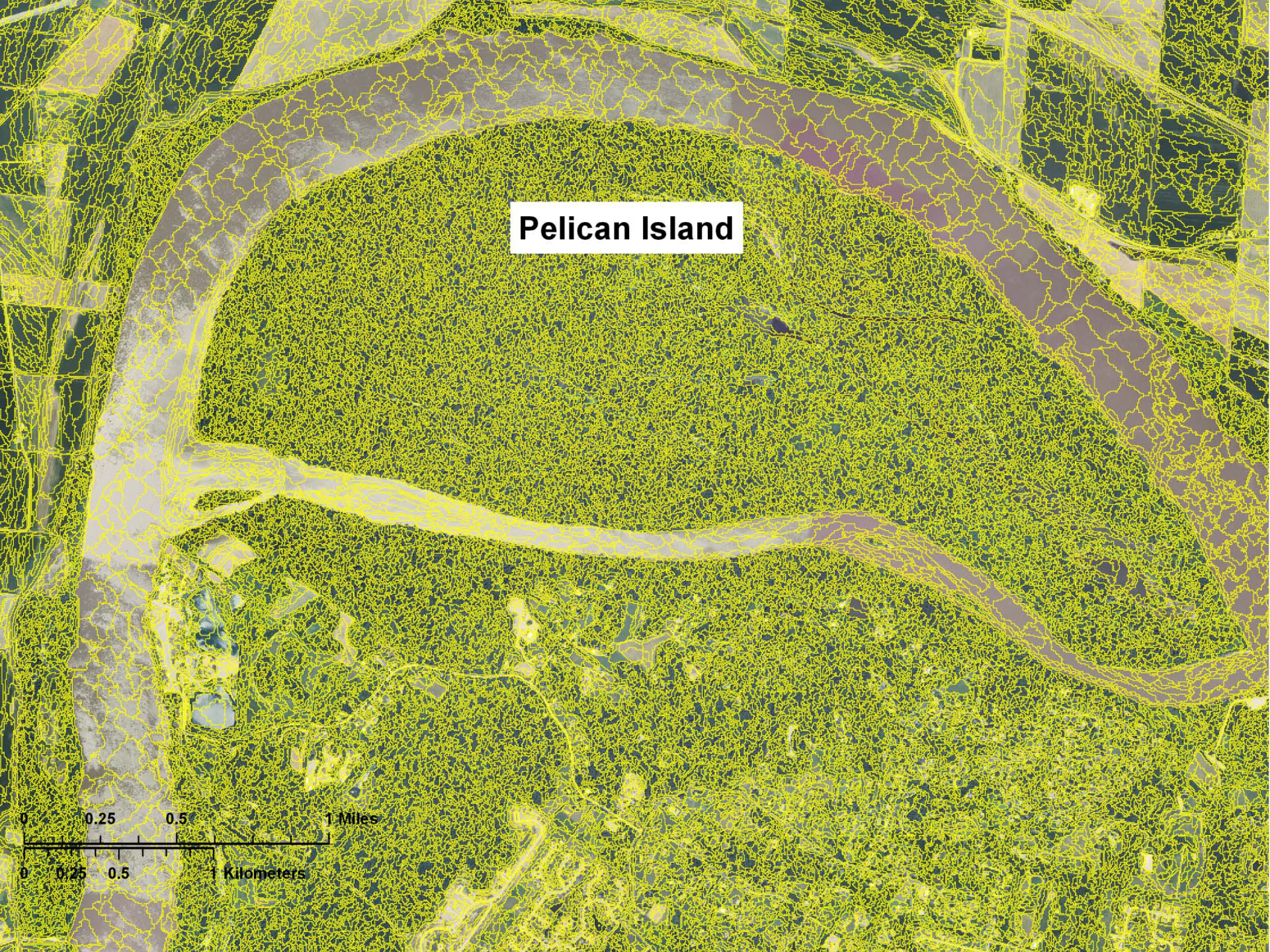


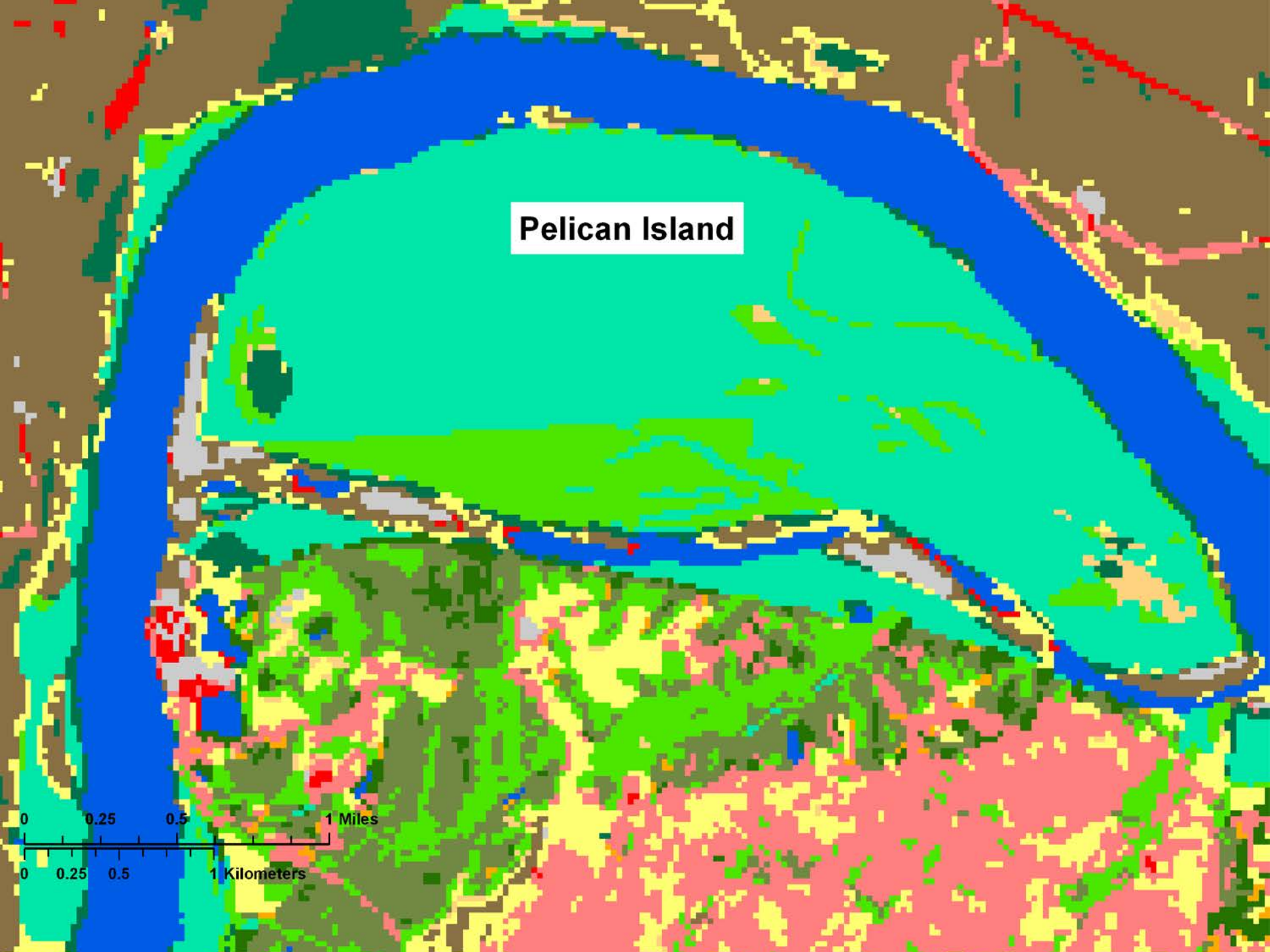
Current vegetation
with final objects

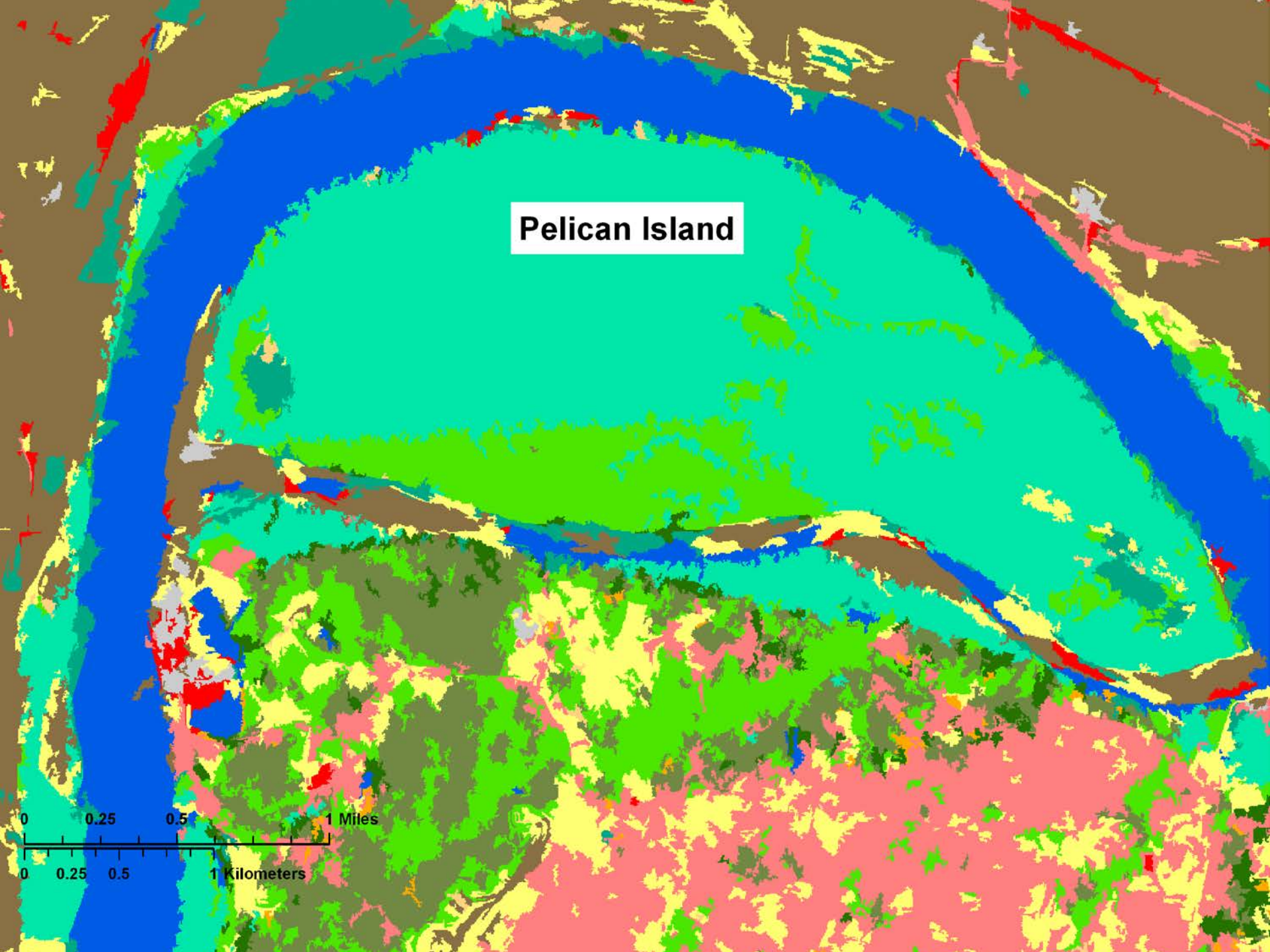


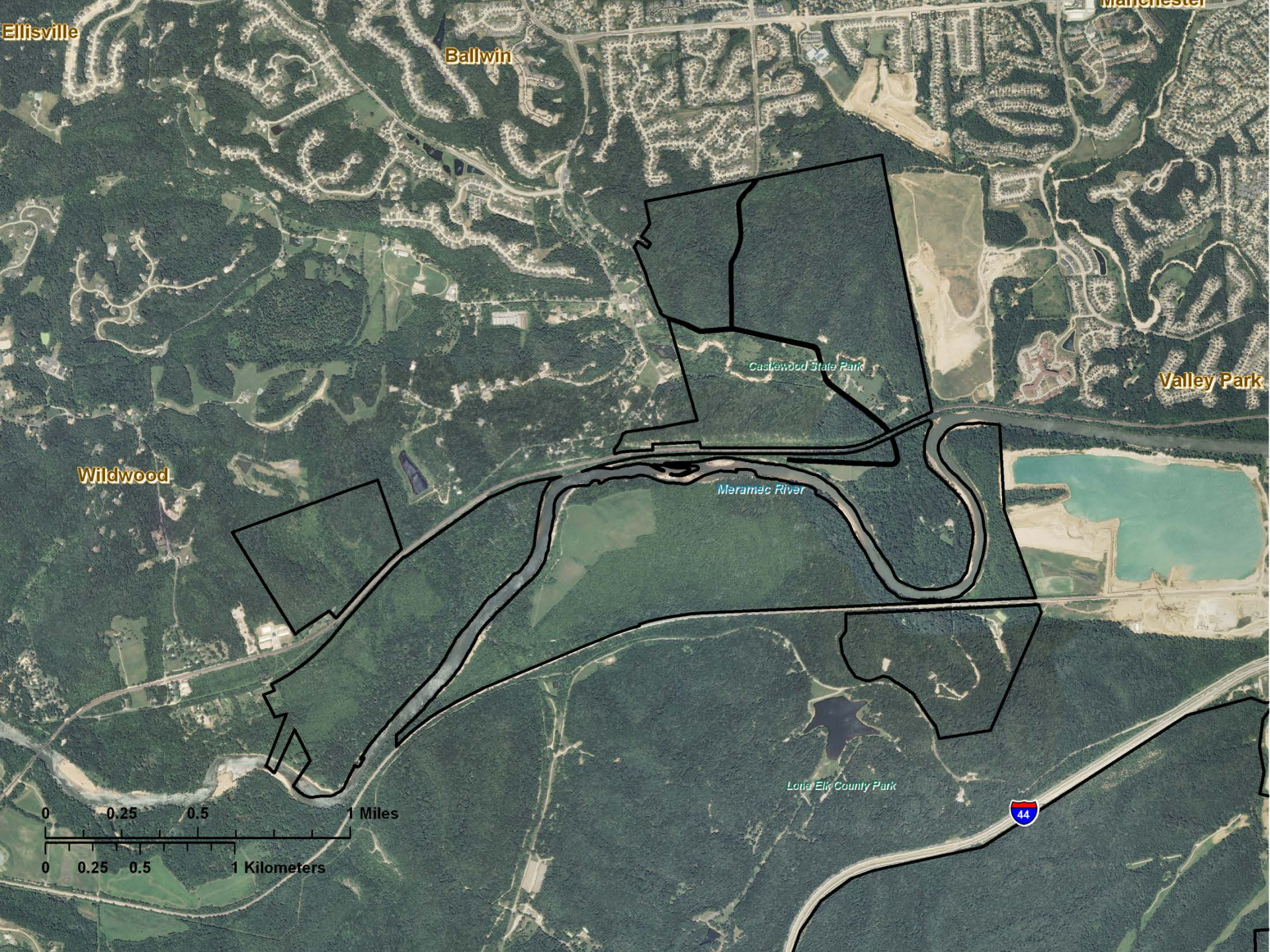


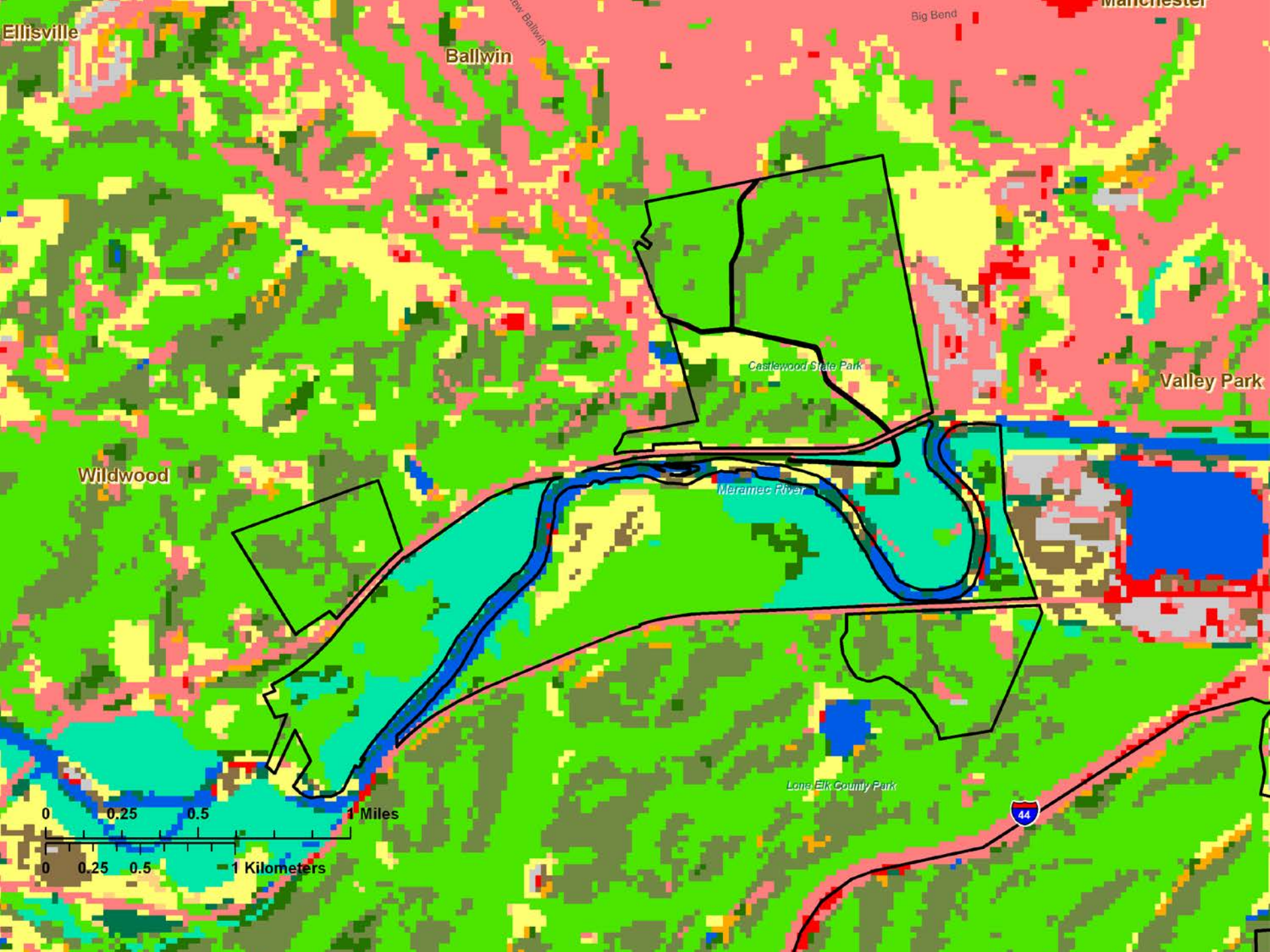
Pelican Island
0 0.25 0.5 1 Miles
0 0.25 0.5 1 Kilometers

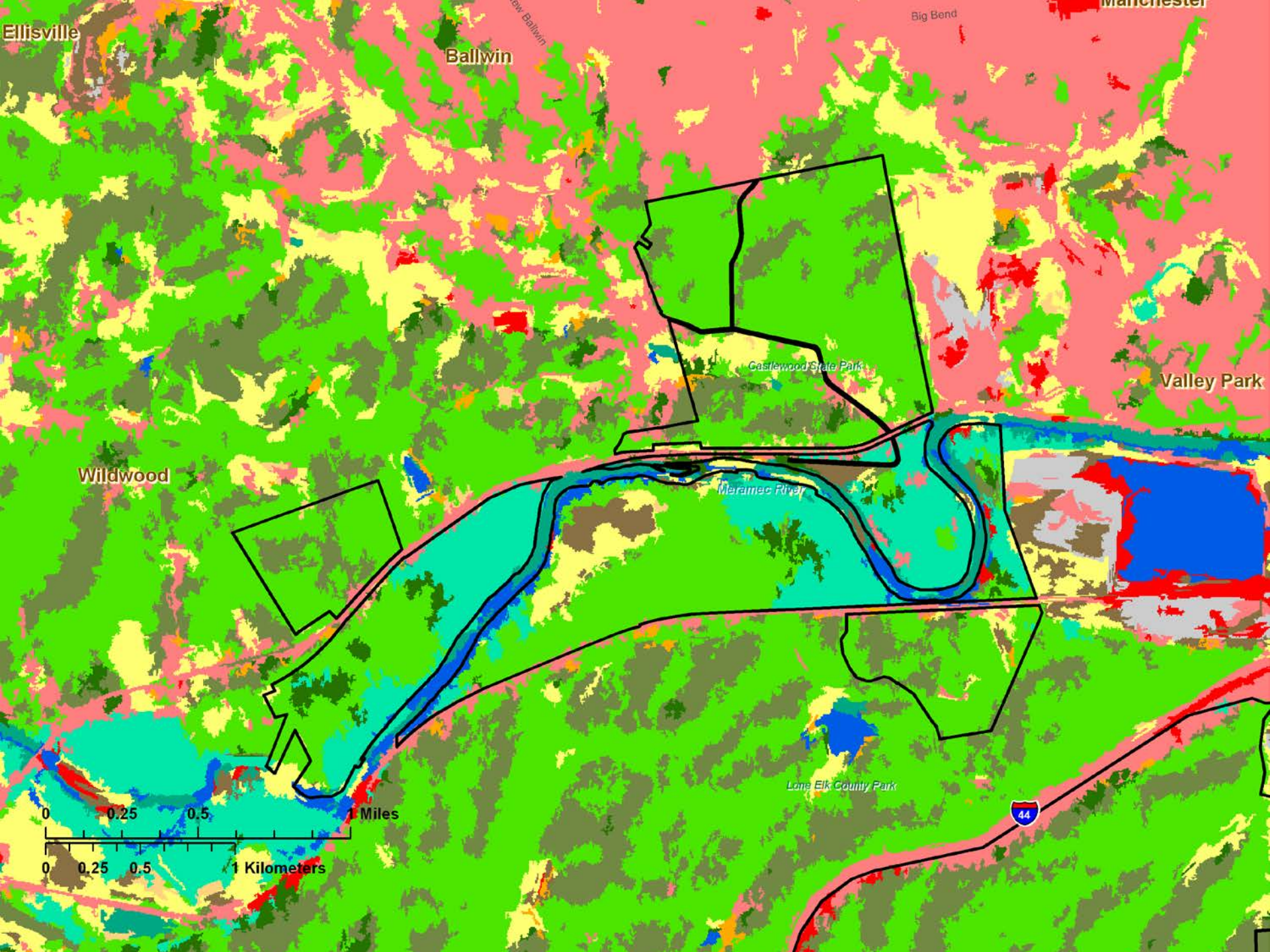

Pelican Island
0 0.25 0.5 1 Miles
0 0.25 0.5 1 Kilometers

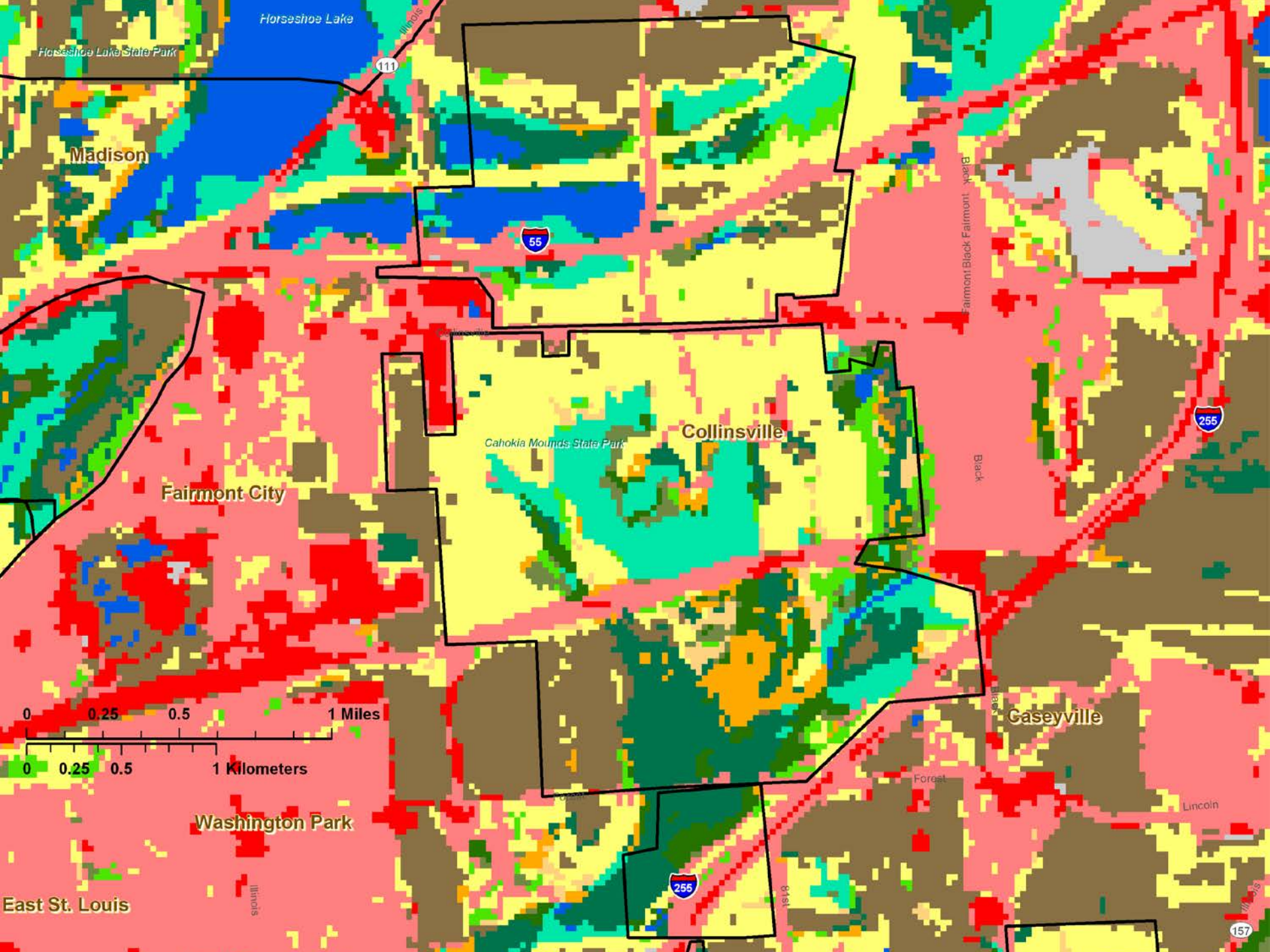

Pelican Island
0
0.25
0.5
1 Miles
0
0.25
0.5
1 Kilometers

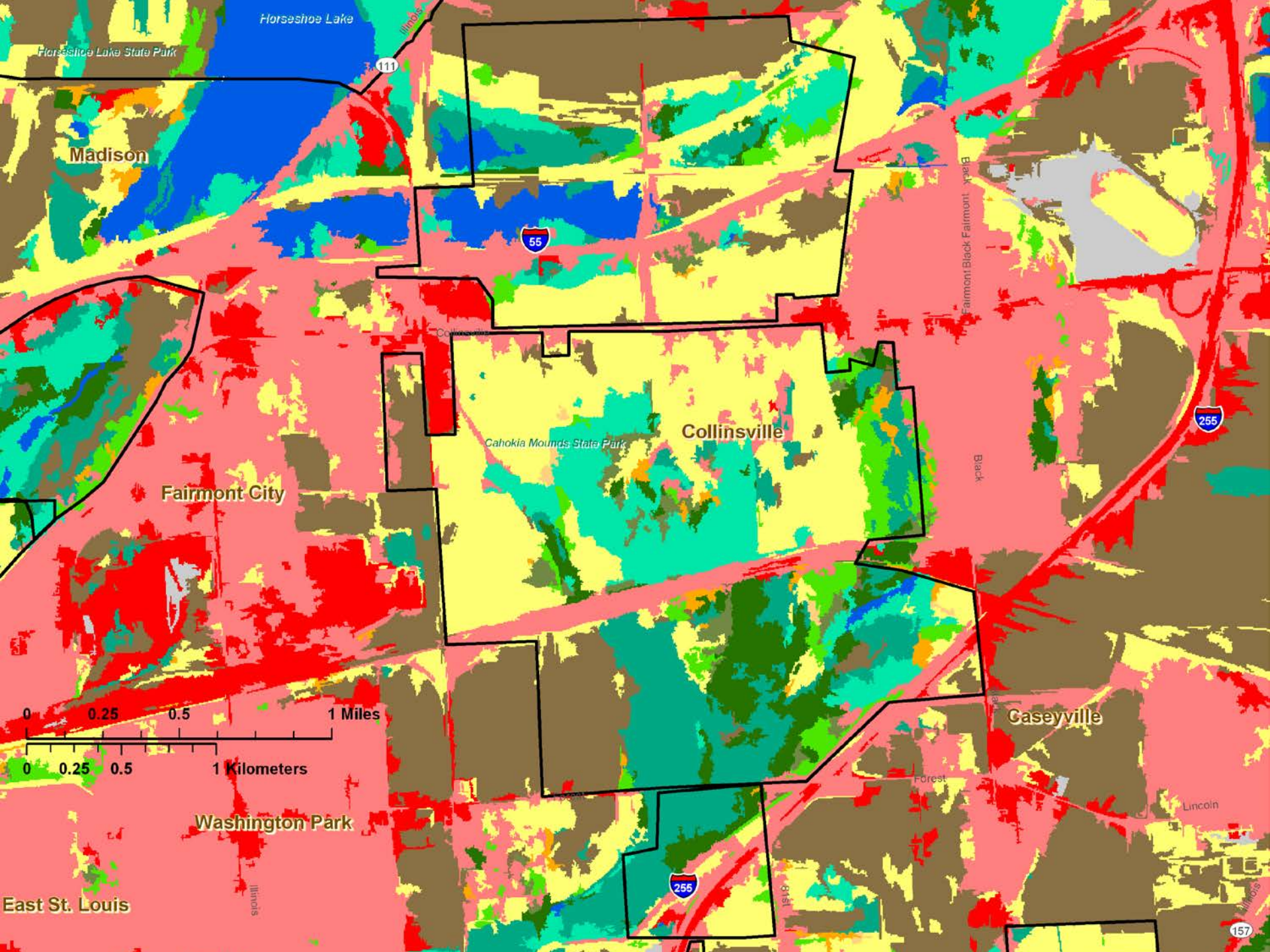

Pelican Island
0
0.25
0.5
1 Miles
0
0.25
0.5
1 Kilometers


Ellisville
Ballwin
Manchester
Castlewood State Park
Valley Park
Wildwood
Meramec River
Lone Elk County Park
44
0 0.25 0.5 1 Miles
0 0.25 0.5 1 Kilometers

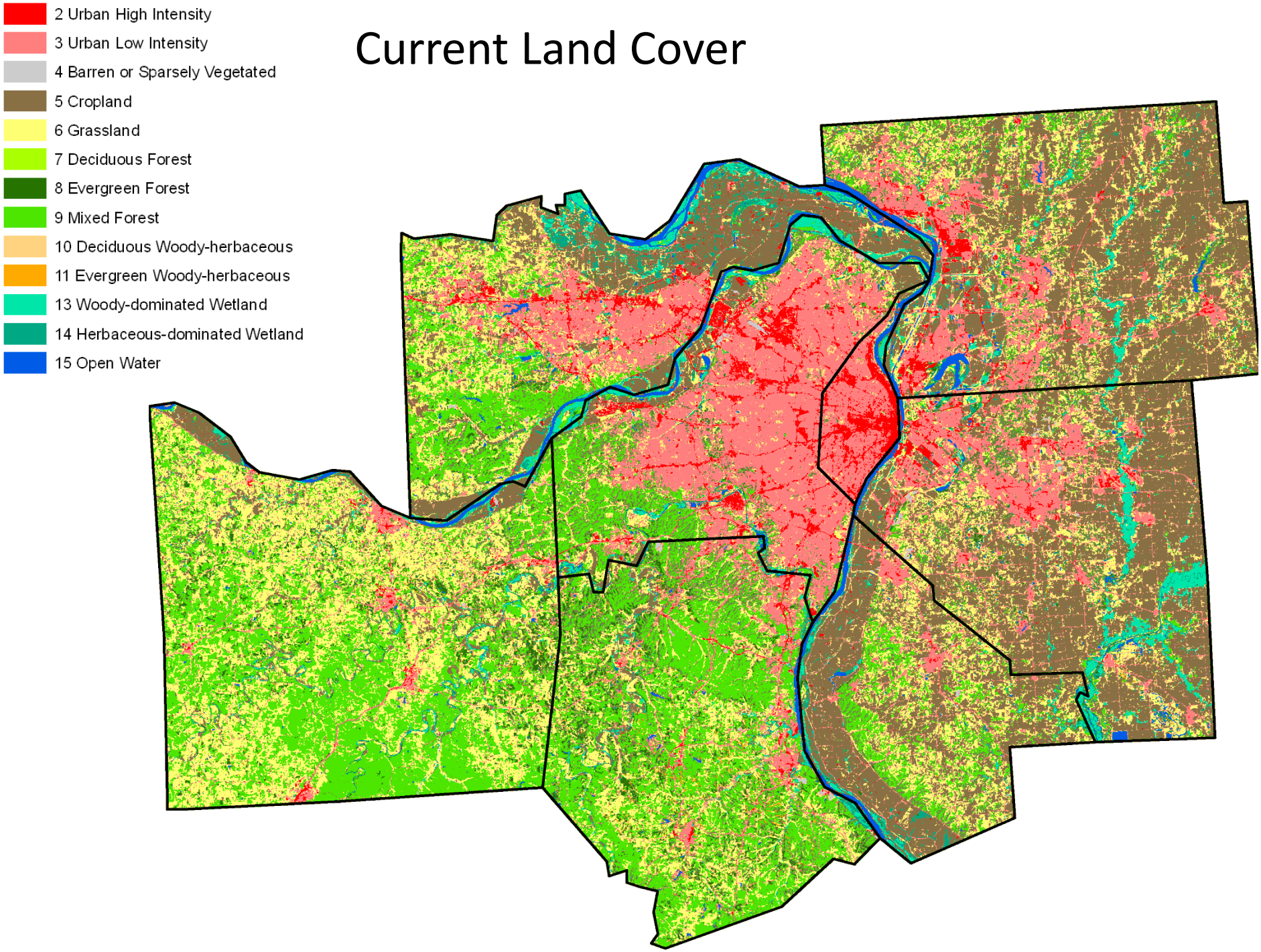

Ellisville
Ballwin
Big Bend
Manchester
Castlewood State Park
Valley Park
Wildwood
Meramec River
Long Elk County Park
44
0
0.25
0.5
1 Miles
0
0.25
0.5
1 Kilometers


Ellisville
Ballwin
Big Bend
Manchester
Castlewood State Park
Valley Park
Wildwood
Meramec River
Lone Elk County Park
44
0 0.25 0.5 1 Miles
0 0.25 0.5 1 Kilometers


Horseshoe Lake
Horseshoe Lake State Park
Illinois
111
Madison
55
Fairmont Black Fairmont
Black
Collinsville
Cahokia Mounds State Park
Fairmont City
255
Caseyville
0 0.25 0.5 1 Miles
0 0.25 0.5 1 Kilometers
Forest
Lincoln
Washington Park
East St. Louis
Illinois
255
81st
157


Horseshoe Lake
Horseshoe Lake State Park
Madison
Collinsville
Cahokia Mounds State Park
Fairmont City
Caseyville
Washington Park
East St. Louis
Fairmont Black Fairmont
Black
Forest
Lincoln
81st
Illinois
55
255
111
157
0 0.25 0.5 1 Miles
0 0.25 0.5 1 Kilometers

Current Land Cover

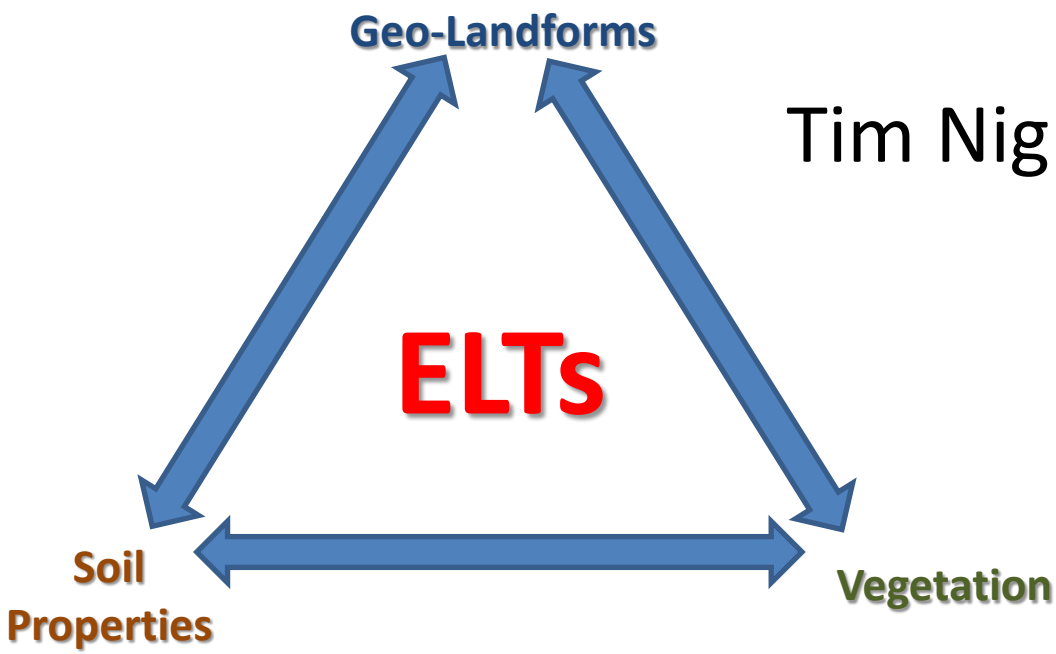


Presentation Outline

- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

ECS Project (MO)

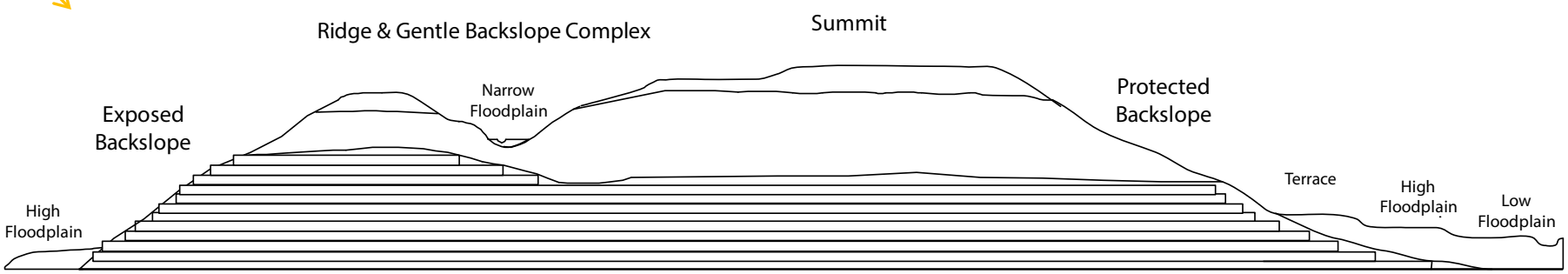
Developing Statewide Ecological Land Types (ELTs) and Ecological Site Descriptions (ESDs)



Tim Nigh and Kyle Steele

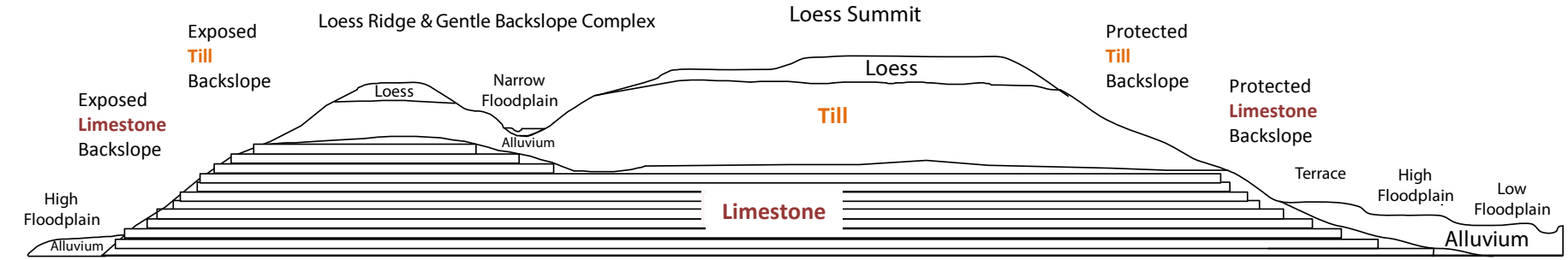
Missouri ELT Development Process

1) **Landforms** are identified within a given landscape.



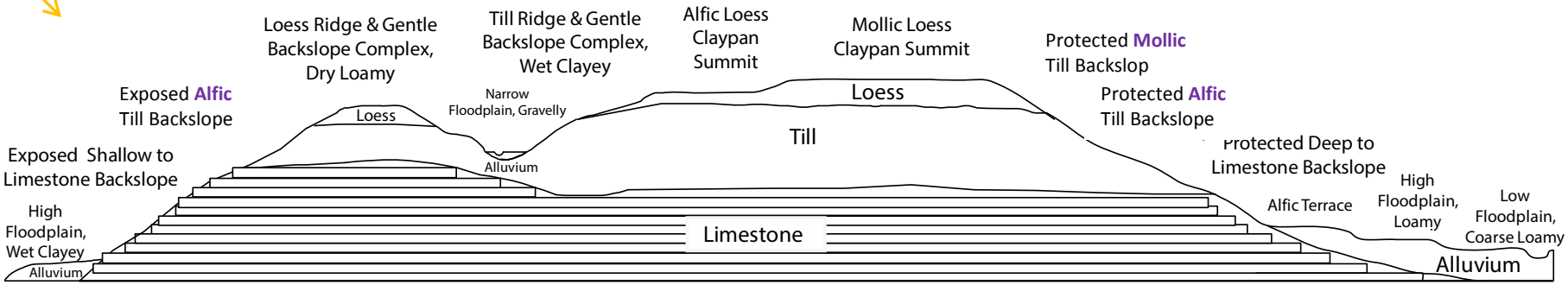
Missouri ELT Development Process

2) **Parent Materials** are then used to further subdivide landforms.



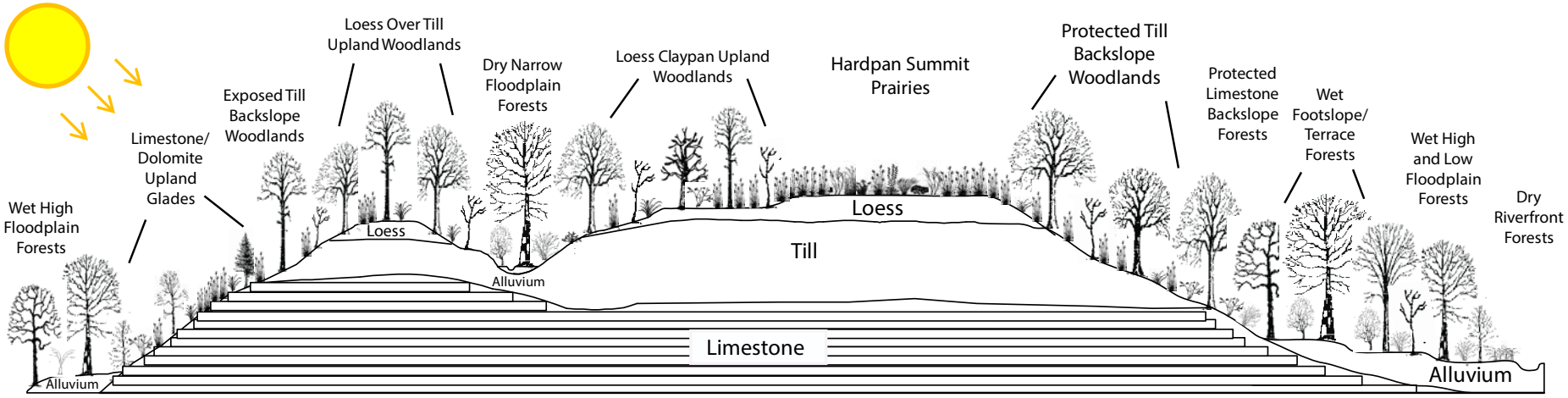
Missouri ELT Development Process

3) **Soil Properties** are then used to further subdivide landform/parent material groups.

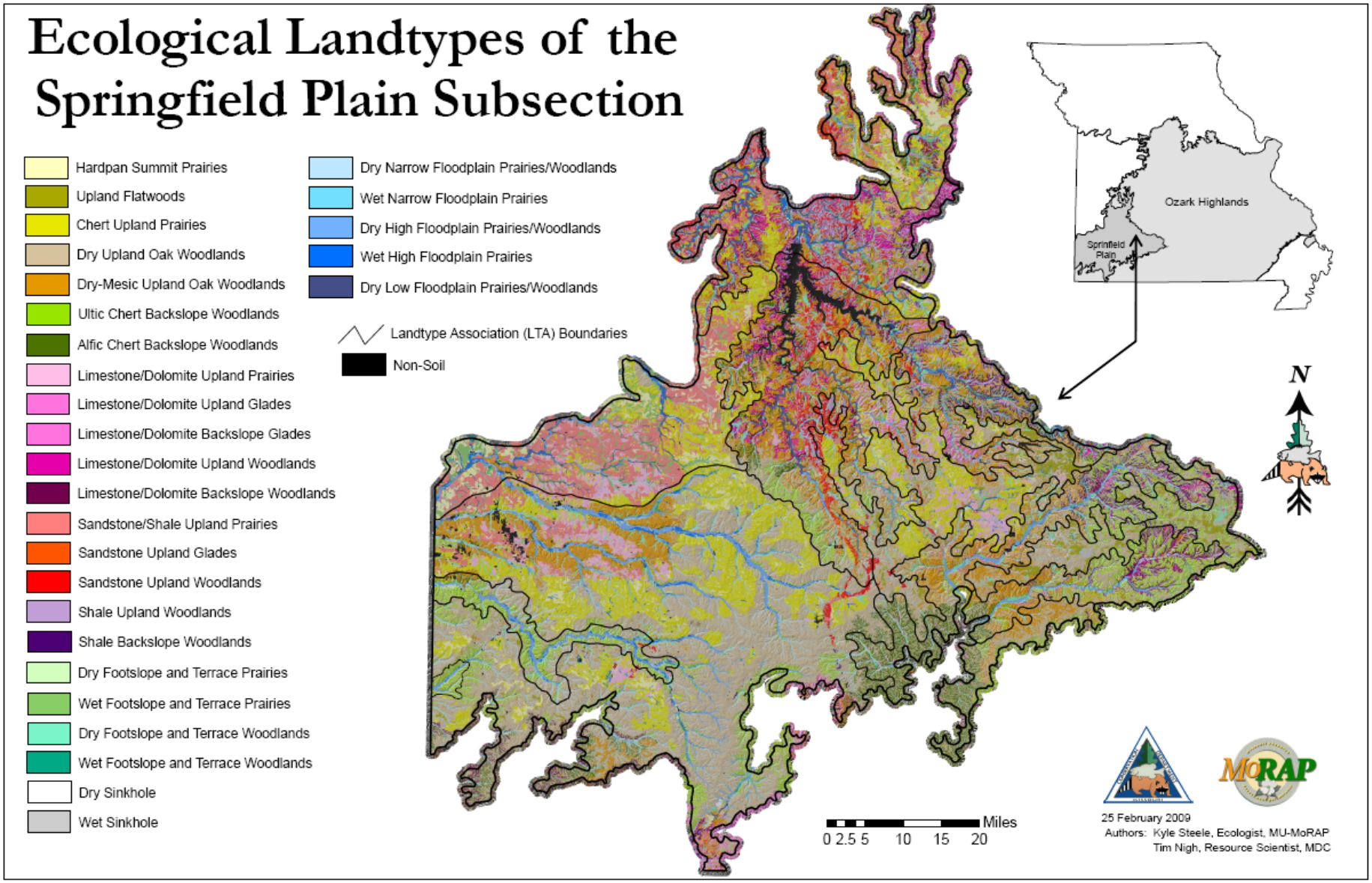


Missouri ELT Development Process

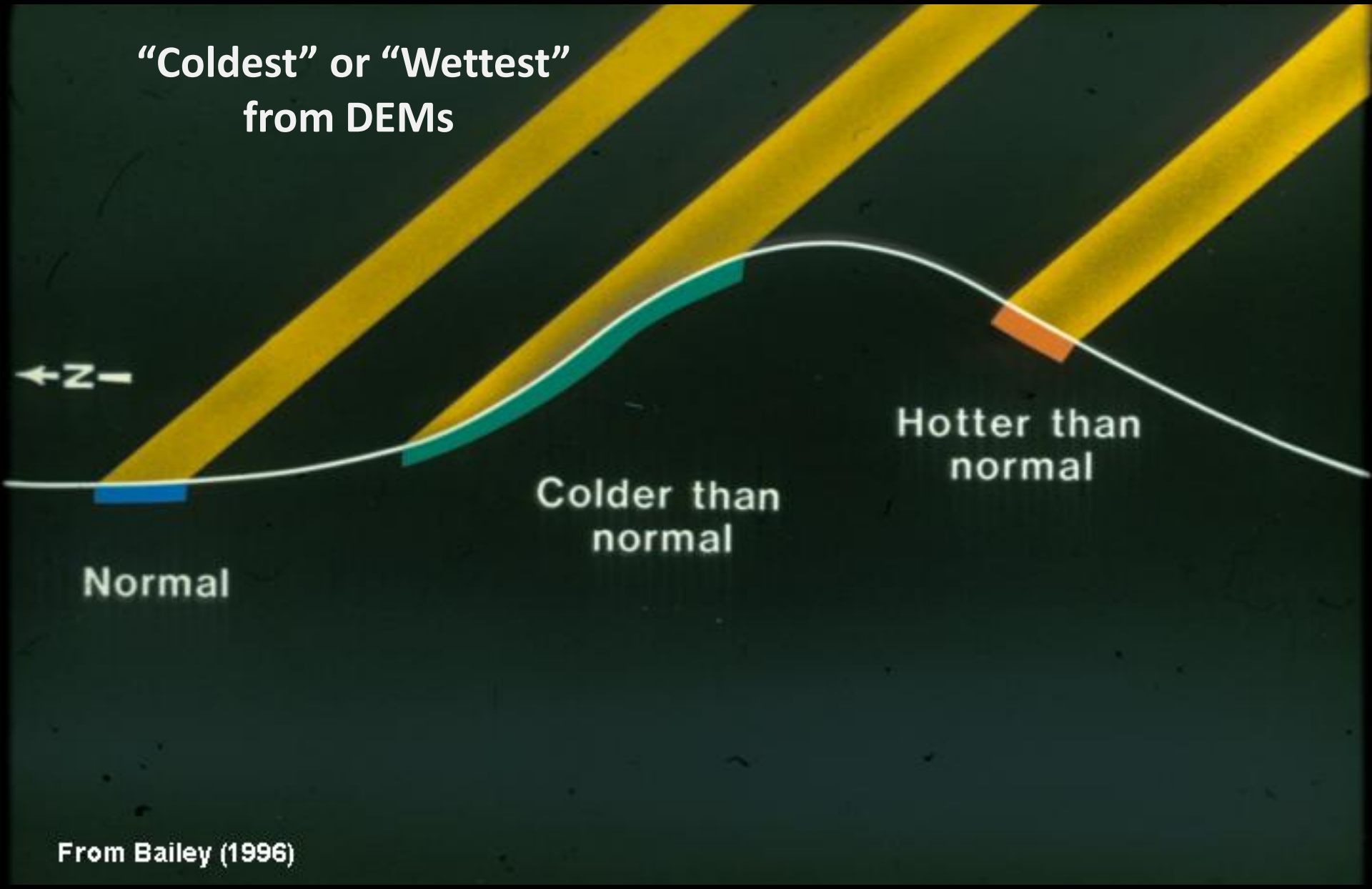
4) Potential **Natural Communities** are then tied to each land unit, resulting in **ELTs and ELT Phases**.



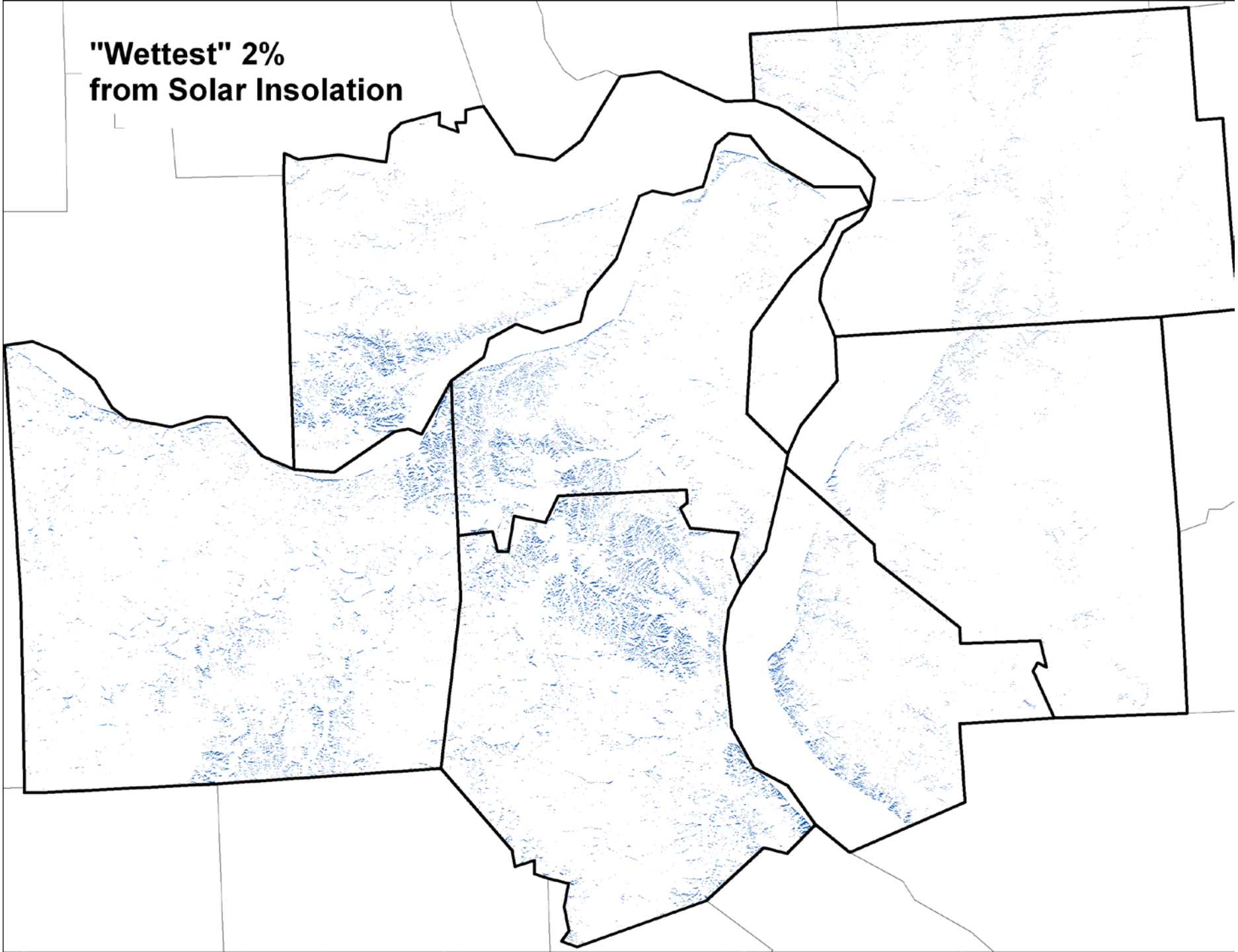
Example for the Springfield Plain



“Coldest” or “Wettest” from DEMs



From Bailey (1996)


"Wettest" 2%
from Solar Insolation

Presentation Outline

- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

Classify Land Cover

Satellite TM Data for 3 Dates (30 m)
Environmental Variables
NAIP Photos for “objects”

Ecological Land Types

SSURGO Soil (ELT) Groups
% Slope
Solar Insolation

Final Mapped Vegetation Types

Classify Land Cover

Satellite TM Data for 3 Dates (30 m)
Environmental Variables
NAIP Photos for “objects”

Ecological Land Types

SSURGO Soil (ELT) Groups
% Slope
Solar Insolation

Final Mapped Vegetation Types

Classify Land Cover

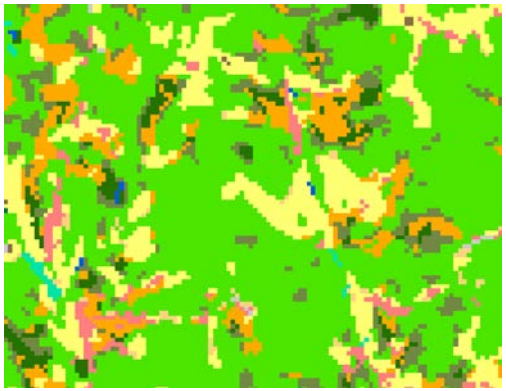
Satellite TM Data for 3 Dates (30 m)
Environmental Variables
NAIP Photos for “objects”

Ecological Land Types

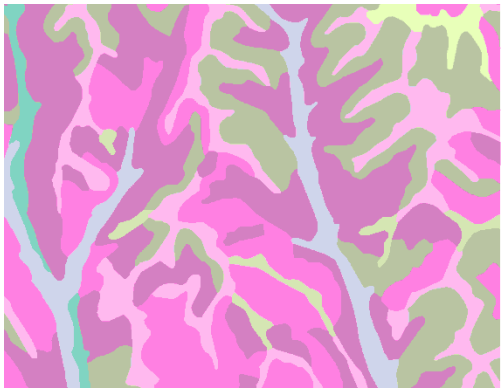
SSURGO Soil (ELT) Groups
% Slope
Solar Insolation

Final Mapped Vegetation Types

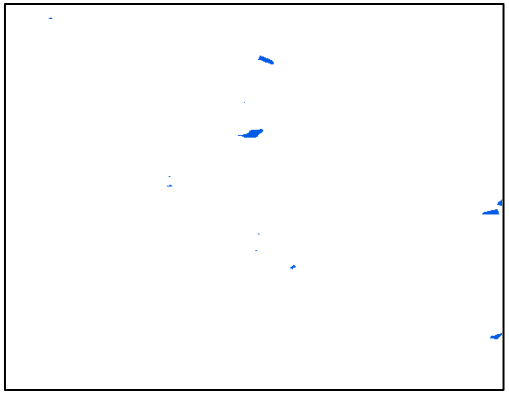
Land Cover and Ancillary Data is Applied to Objects



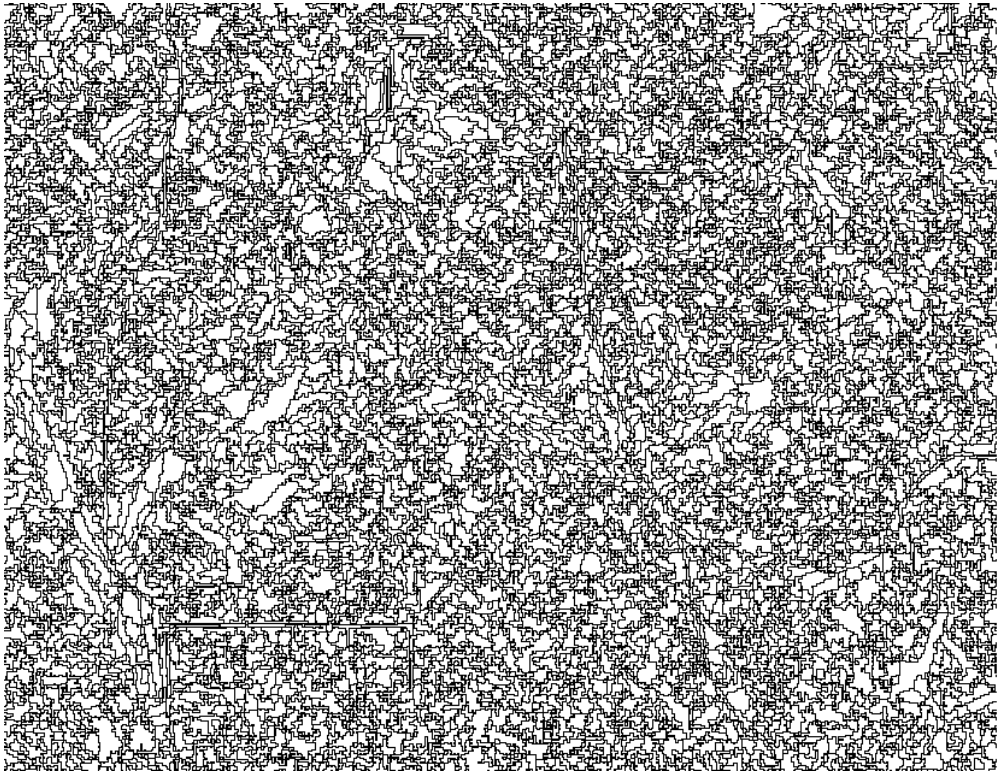
Land Cover



ELT's



"Wettest" Areas



Key

	A	B	C	D	Land Cover			H	I	J	K	L
1	Site Type Group	Grassland	Deciduous Forest	Evergreen Forest	Mixed Forest	Deciduous Woody-herbaceous	Evergreen Woody-herbaceous	Woody-dominated Wetland	Herbaceous-dominated Wetland	Barren or Sparsely Vegetated	Open Water	Impervious
2	Bottom[illegible]st: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	59	1	[illegible]	63	60	62	74	45	50		
3	Bott[illegible] forest: Red Oak/Sycamore-Sugar Maple/Cottonwood Forest	59	2	[illegible]	63	60	62	74	45	50		
4	B[illegible]mland Forest: White Oak/Red Oak-Dogwood/Sycamore Forest	59	3	61	63	60	62	74	45	50		
5	[illegible]ntral Dissected Till Plains: Upland Claypan Bluestem Prairie	4	5	65	64	53	52	47	46			
6	Central Dissected Till Plains: Loess and Till Upland Bur Oak/Post Oak Upland Woodland	8	5	65	[illegible]4	53	52	47	46			
7	Central Dissected Till Plains: Till Backslope White Oak/Black Oak-Hickory Woodland and Forest	72	6	65	[illegible]	72	72	47	46	72		
[illegible]	Central Dissected Till Plains: Till Mesic Backslope Red Oak/White Oak-Sugar Maple/Basswood Forest	72	57	65	6[illegible]	72	72	47	46	72		
[illegible]	Central Dissected Till Plains: Upland Bur Oak/Post Oak-Bluestem Prairie and Savanna	8	66	65	64	53	52	47	46			
10	Missouri River Floodplain: Dry Terrace and Floodplain White Oak-Sugar Maple Forest	59	9	61	63	60	62	74	45	50		
11	Missouri River Floodplain: Wet Floodplain Pin Oak/Cottonwood-Swamp White Oak/Green Ash Forest	59	10	61	63	60	62	74	45	50		
12	Ozark Highlands: Alluvial Backslope White Oak/Black Oak-Hickory Woodland and Forest	72	11	65	64	72	52	74	45	72		
13	Ozark Highlands: Alluvial Mesic Backslope Red Oak/White Oak-Sugar Maple/Basswood Woodland and Forest	72	12	65	64	72	52	74	45	72		
14	Ozark Highlands: Carbonate Cliffs and Talus	13	13	13	13	13	13	13	13	13	13	13
15	[illegible]zark Highlands: Chert Backslope White Oak/Black Oak-Dogwood Woodland and Forest	27	14	27	27	27	27	47	46	27		
16	[illegible]ark Highlands: Chert Mesic Backslope Red Oak/White Oak-Sugar Maple/Basswood Forest	27	15	65	27	27	27	47	46	27		

	A	B
	Site Type Group	ELT_NAME
[illegible]	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	57 Wet High Floodplain Forests
[illegible]	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	47 Wet Pleistocene Terrace Forests*
4	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	53 Wet Terrace Forests
5	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	53 Wet Terrace Forests*
6	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	47 Wet Pleistocene Terrace Forests
7	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	51 Wet Footslope Forests
8	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	51 Wet Footslope Forests*
9	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	57 Wet High Floodplain Forests*
10	Bottomland Forest: Red Oak/Sycamore-Sugar Maple/Cottonwood Forest	52 Dry Terrace Forests
11	Bottomland Forest: Red Oak/Sycamore-Sugar Maple/Cottonwood Forest	66/56 Urban Land AND Dry High Floodplain Fore
12	Bottomland Forest: Red Oak/Sycamore-Sugar Maple/Cottonwood Forest	55 Wet Narrow Floodplain Forests

Mapped Site Types (from ELTs, DEMs)

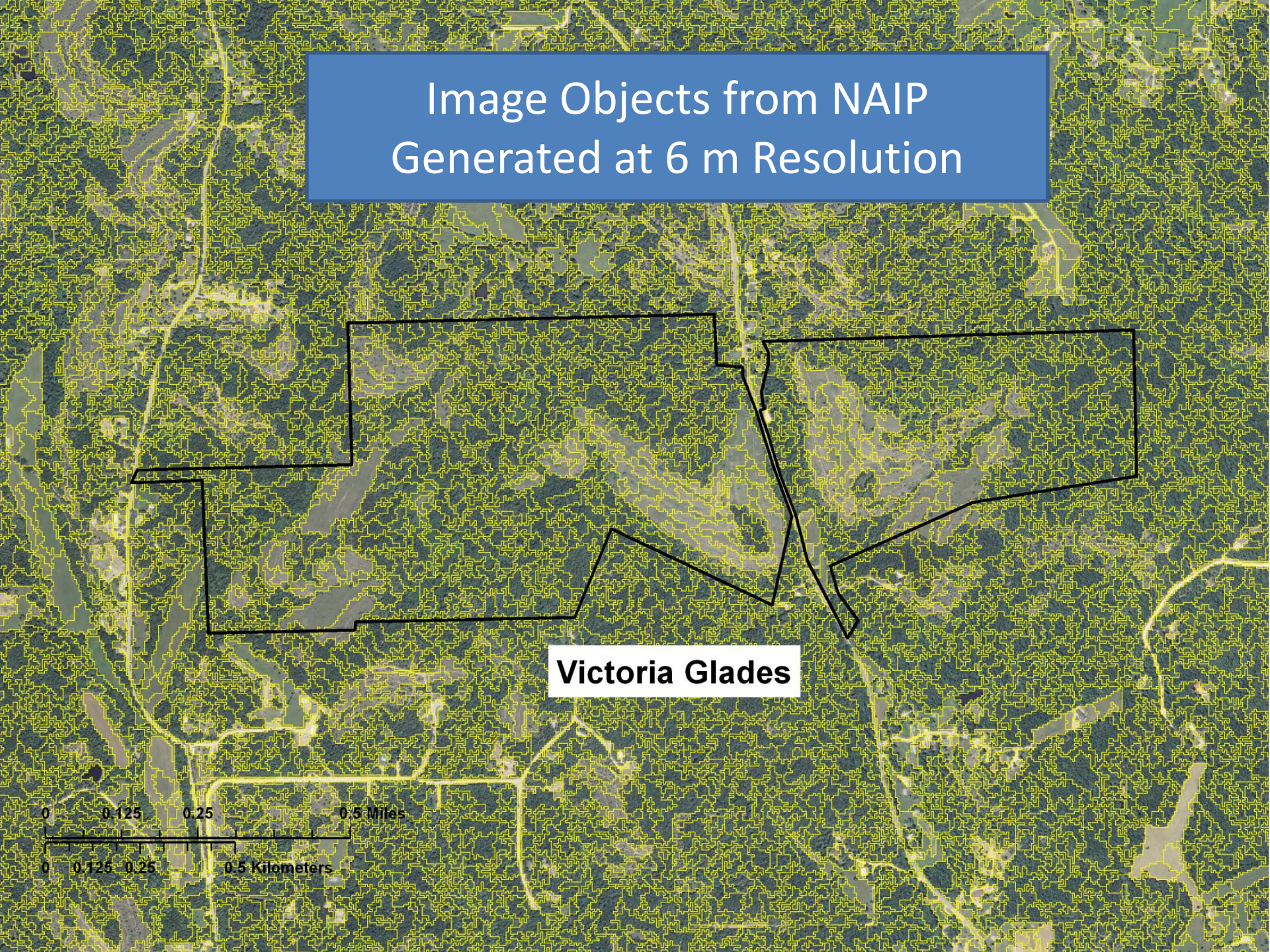
OB_ELTs 2003 v5.xlsx - Microsoft Excel

	A	B	C
1	Current Vegetation	Number	
2	Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	1	
3	Bottomland Forest: Red Oak/Sycamore-Sugar Maple/Cottonwood Forest	2	
4	Bottomland Forest: White Oak/Red Oak-Dogwood/Sycamore Forest	3	
5	Central Dissected Till Plains: Upland Claypan Bluestem Prairie	4	
6	Central Dissected Till Plains: Loess and Till Upland Bur Oak/Post Oak Upland Woodland	5	
7	Central Dissected Till Plains: Till Backslope White Oak/Black Oak-Hickory Woodland and Forest	6	
9	Central Dissected Till Plains: Loess or Till Upland Bur Oak/Post Oak-Bluestem Prairie and Savanna (grassy)	8	
10	Missouri River Floodplain: Dry Terrace and Floodplain White Oak-Sugar Maple Forest	9	
11	Missouri River Floodplain: Wet Floodplain Pin Oak/Cottonwood-Swamp White Oak/Green Ash Forest	10	
12	Ozark Highlands: Alluvial Backslope White Oak/Black Oak-Hickory Woodland and Forest	11	
13	Ozark Highlands: Alluvial Mesic Backslope Red Oak/White Oak-Sugar Maple/Basswood Forest	12	
14	Ozark Highlands: Carbonate Cliffs and Talus	13	
15	Ozark Highlands: Chert Backslope White Oak/Black Oak-Dogwood Woodland and Forest	14	

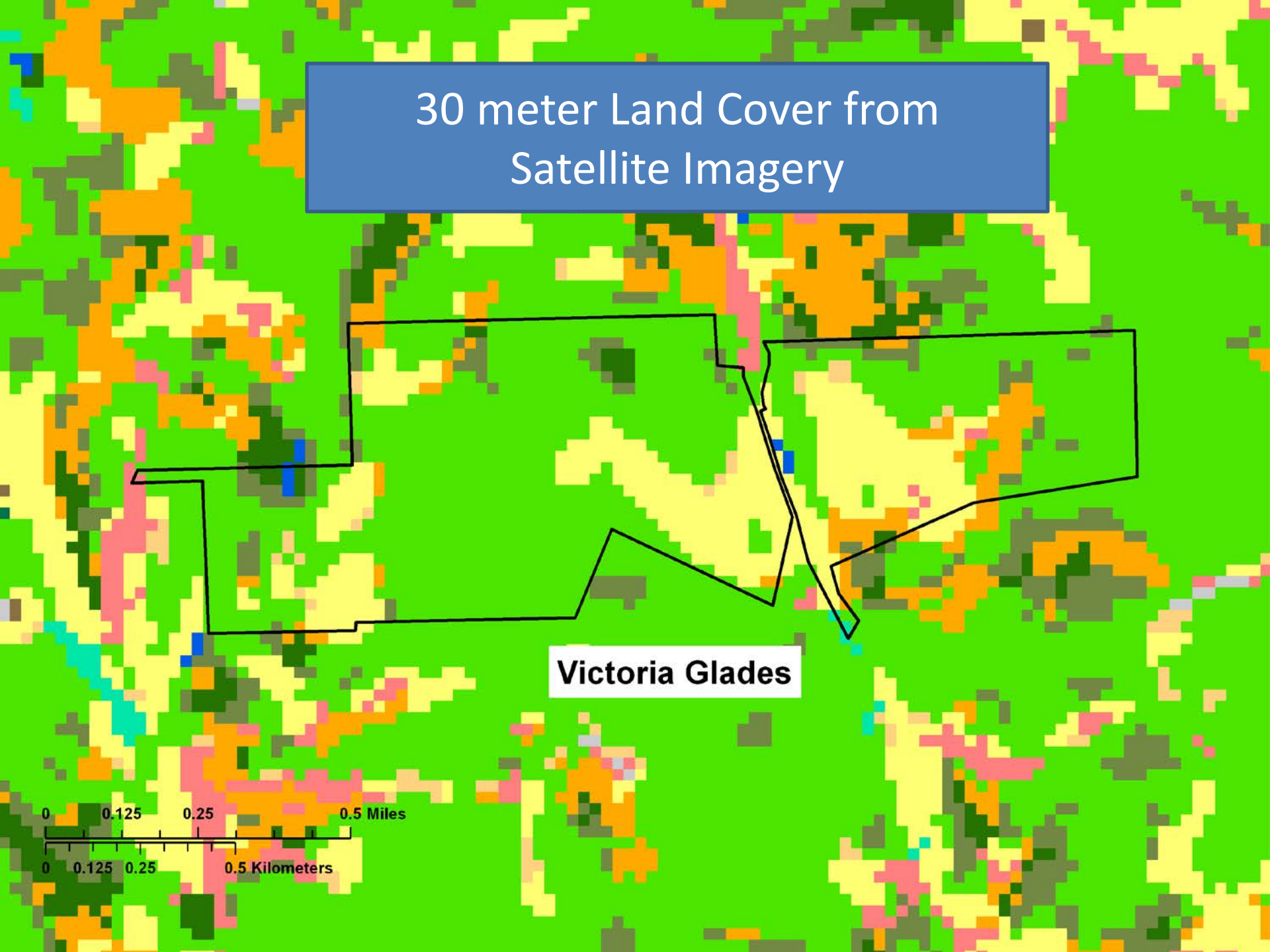
Mapped Vegetation Target List (includes disturbance and successional types)

Victoria Glades
0
0.125
0.25
0.5 Miles
0
0.125
0.25
0.5 Kilometers

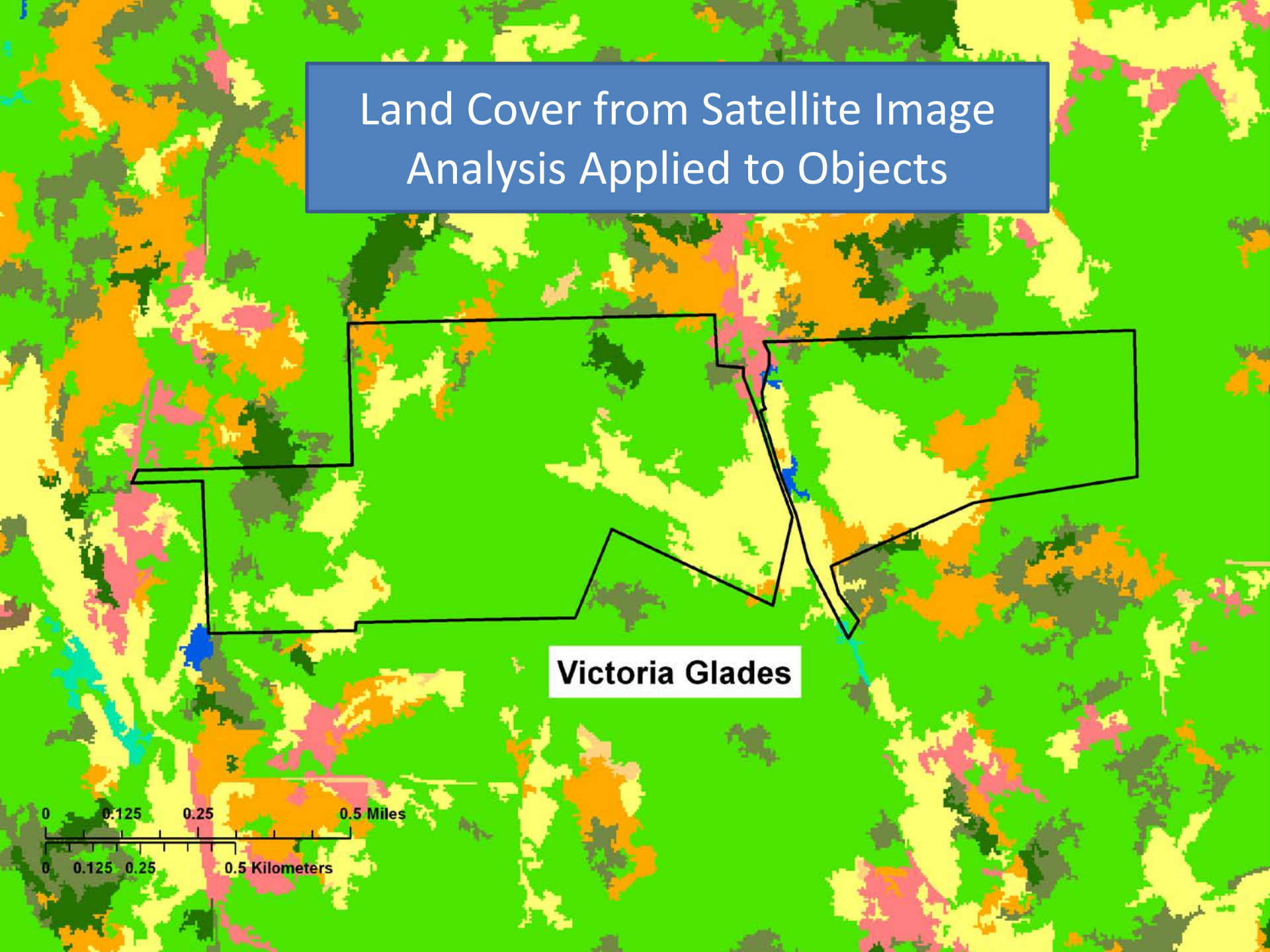
Image Objects from NAIP Generated at 6 m Resolution



30 meter Land Cover from Satellite Imagery



Land Cover from Satellite Image Analysis Applied to Objects



Current Vegetation Classes for Victoria Glades Area

3 Urban Low Intensity

5 Cropland

6 Grassland
- Bottomland: Herbaceous Vegetation
- Cultural/Disturbance: Upland Limestone/Dolomite and Chert Grassland
- Cultural/Disturbance: Upland Loess and Till Grassland
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (grassy)

7 Deciduous Forest
- Bottomland Forest: Mixed Bottomland Hardwood Forest
- Bottomland Forest: Sycamore, Cottonwood, Elm, Ash Hackberry Riverfront Forest
- Ozark Highlands: Mesic Backslope and Valley Red Oak/White Oak-Sugar Maple/Basswood Forest
- Ozark Highlands: Chert Backslope White Oak/Black Oak-Dogwood Woodland and Forest
- Ozark Highlands: Chert Upland Post Oak-Bluestem Prairie and Savanna (wooded)
- Ozark Highlands: Limestone/Dolomite Backslope White Oak/Chinquapin Oak-Dogwood Woodland and Forest
- Ozark Highlands: Limestone/Dolomite Upland Chinquapin Oak-Post Oak/White Oak Woodland
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (deciduous woods)
- Ozark Highlands: Loess and Till Upland Post Oak/White Oak-Black Oak Woodland

8 Evergreen Forest
- Bottomland: Successional Eastern Redcedar Woodland
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (juniper or mixed woods)
- Successional Upland Eastern Redcedar Evergreen Woodland and Forest

9 Mixed Forest
- Bottomland: Successional Eastern Redcedar-Deciduous Mixed Woodland and Forest
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (juniper or mixed woods)
- Successional Upland Eastern Redcedar-Deciduous Mixed Woodland and Forest

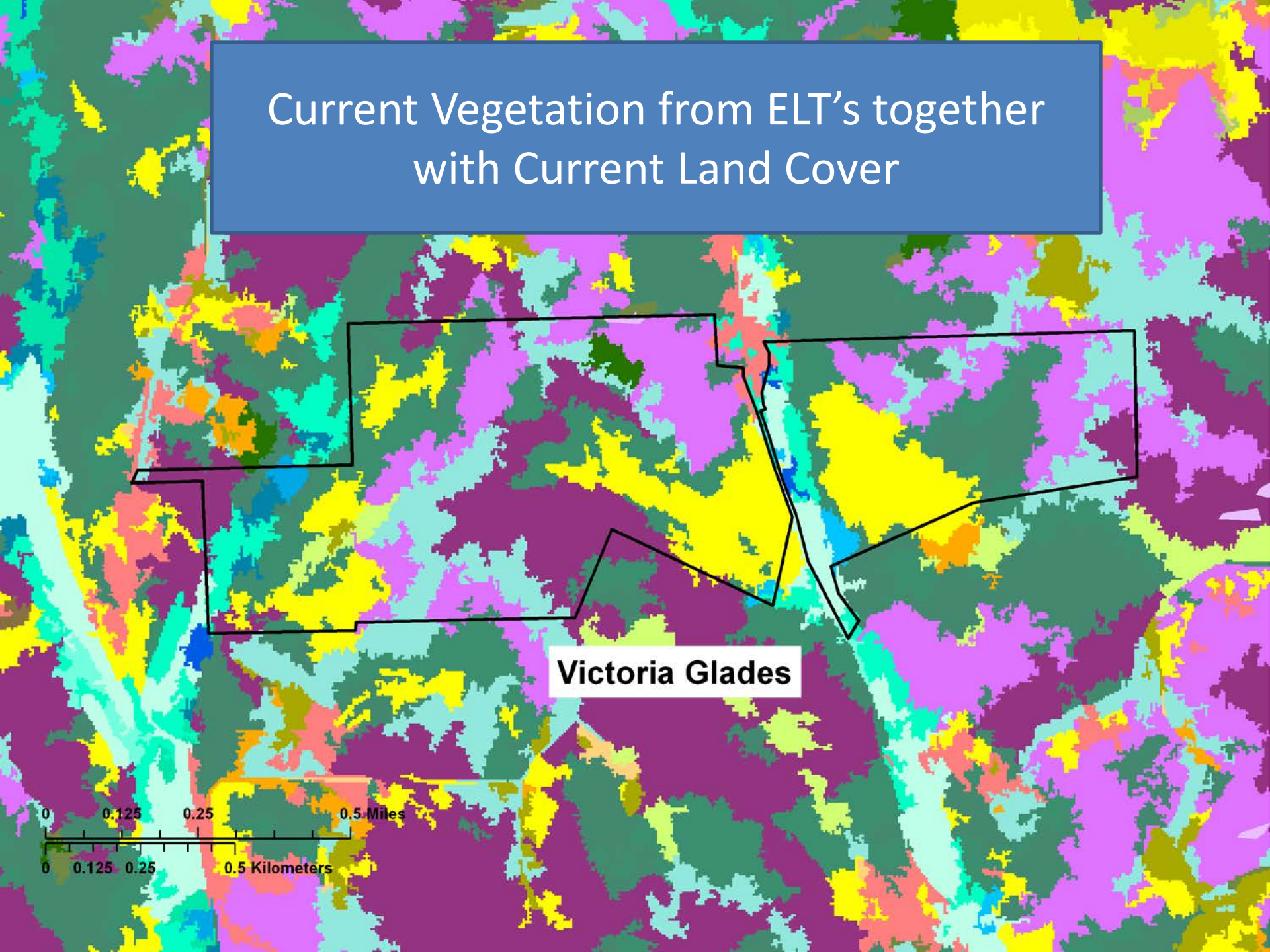
10 Deciduous Woody-herbaceous
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (deciduous woods)
- Successional Upland Deciduous Sparse Woodland and Shrubland

11 Evergreen Woody-herbaceous
- Bottomland: Successional Eastern Redcedar Sparse Woodland and Shrubland
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (deciduous woods)
- Successional Upland Eastern Redcedar Evergreen Sparse Woodland and Shrubland

13 Woody-dominated Wetland
- Bottomland: Buttonbush/Black Willow-Water Locust Woody Wetland
- Woody-dominated Wetland (non-riverine)

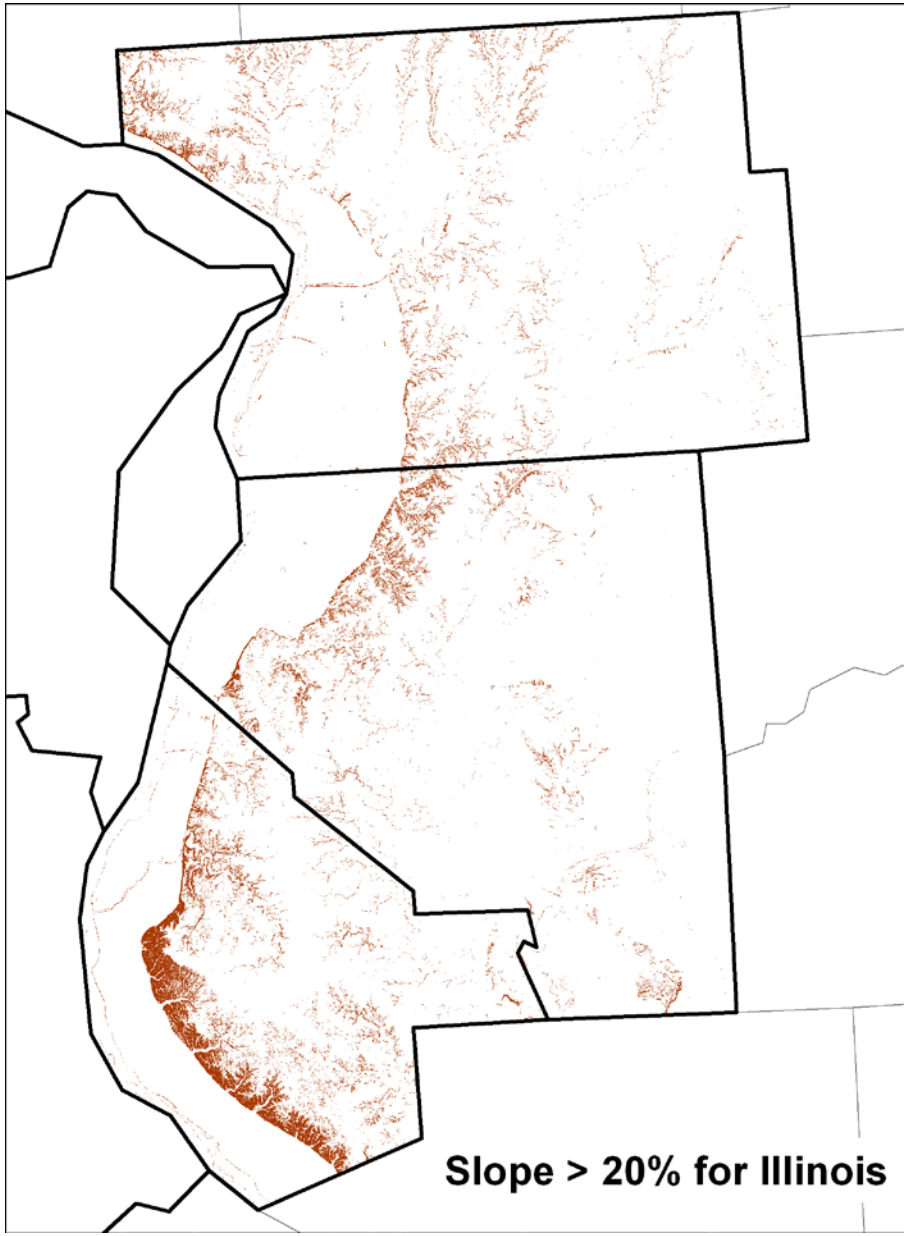
15 Open Water

Current Vegetation from ELT's together with Current Land Cover



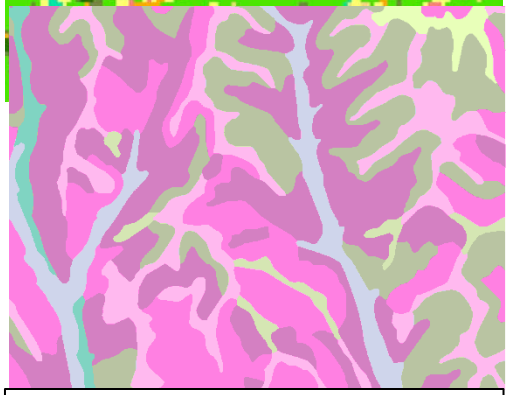
Illinois has no ELTs

- Created soil groups from SSURGO Soils
- "Wettest" areas from Solar Insolation
- Developed "Steepest Area" data layer from DEM



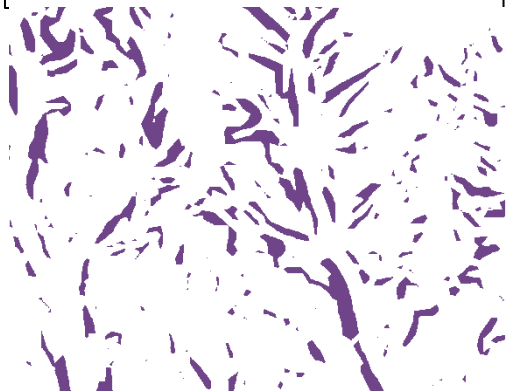
Land Cover and Ancillary Data is Applied to Objects in Illinios

Land Cover

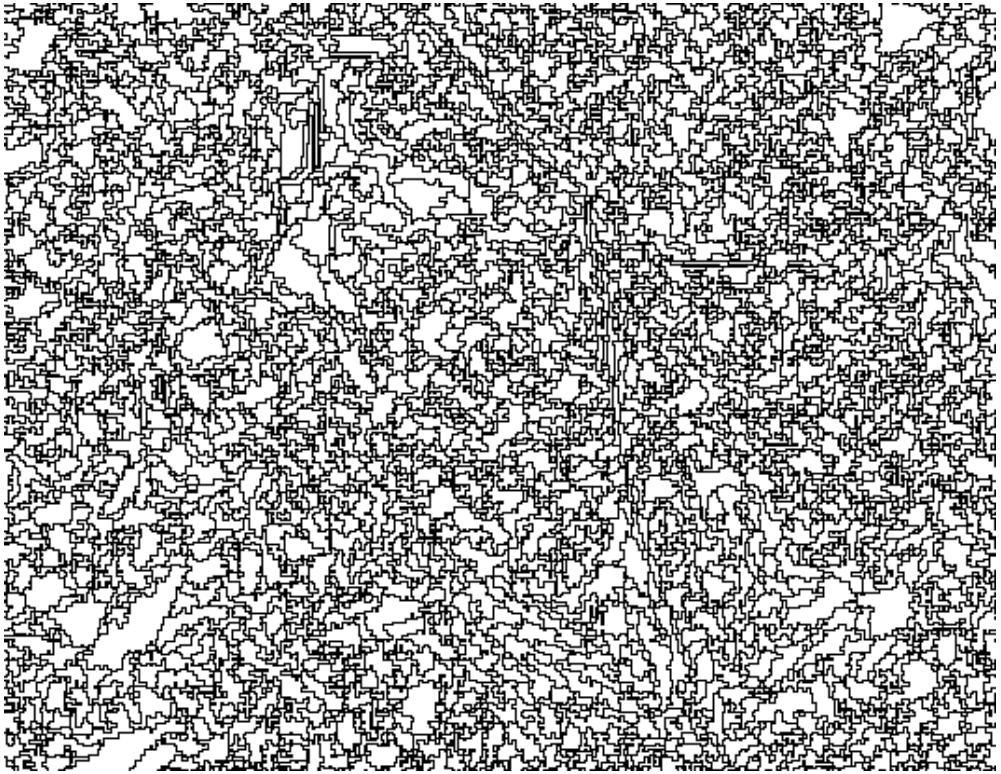


Soils

"Wettest" Areas



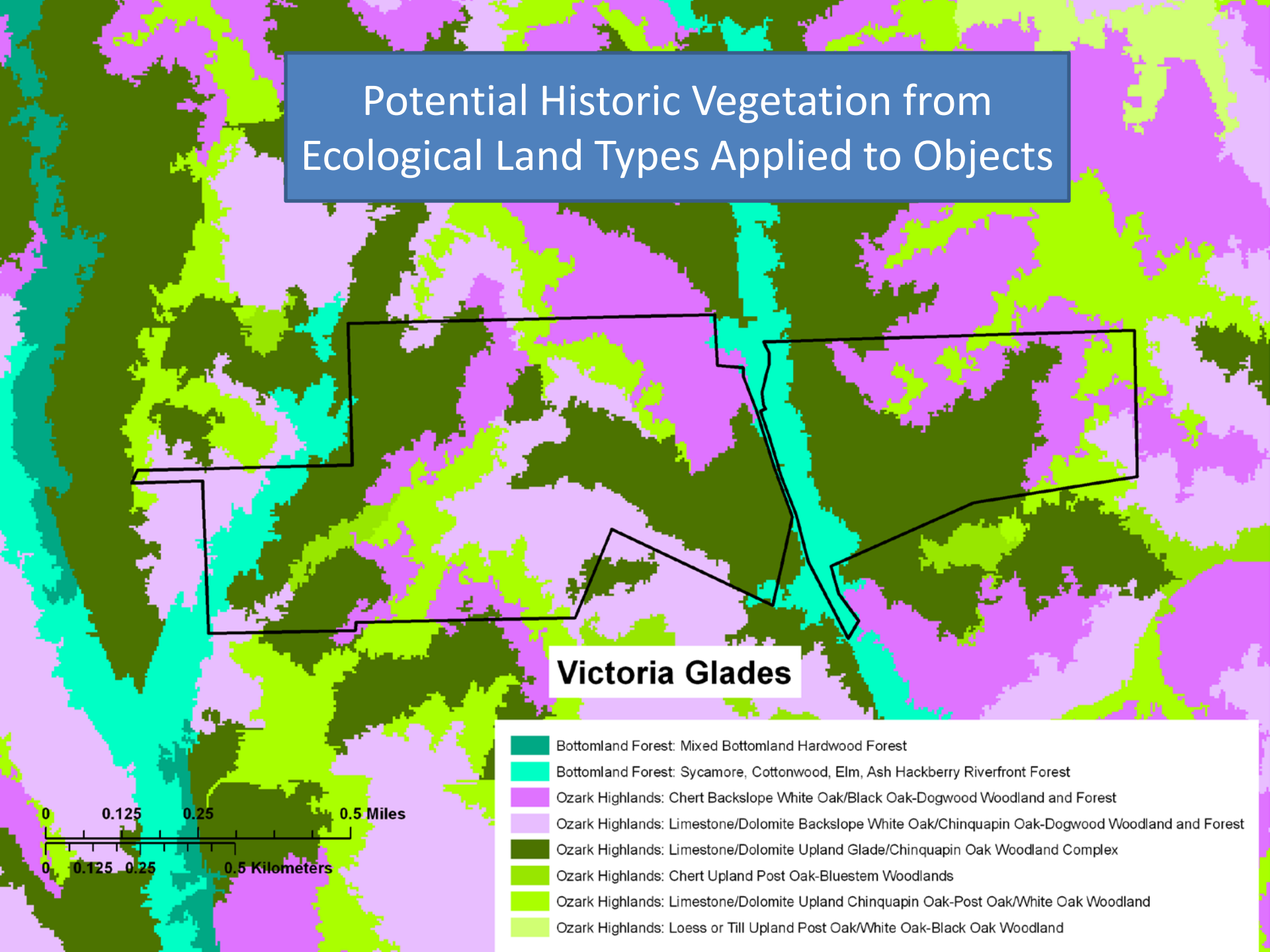
Steep Slopes

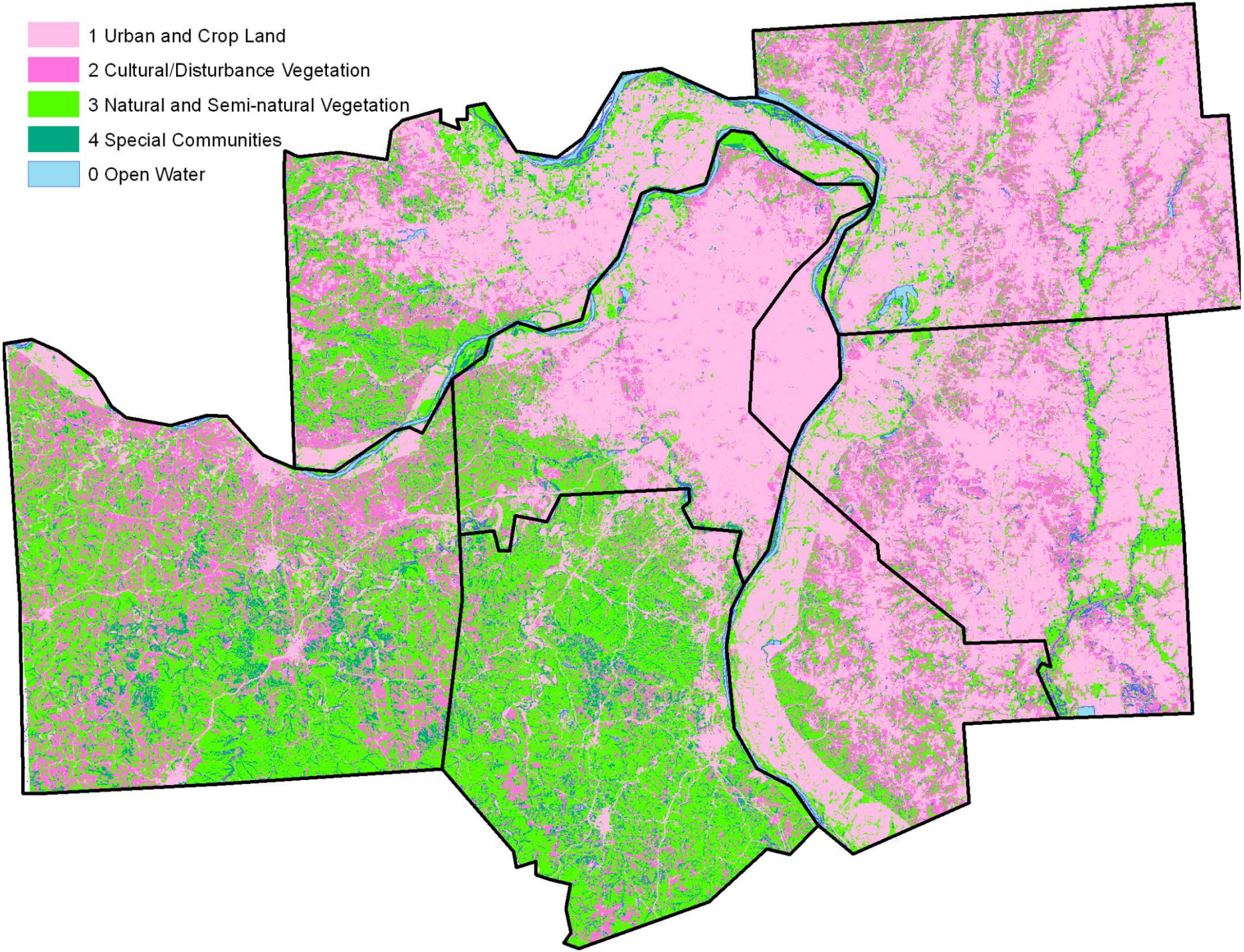


Current Vegetation

- Objects from 6 meter NAIP
- Land Cover from 30 m satellite imagery
- ELT’s in Mo
- Soils, steepest, and wettest in IL
- 60 vegetation units (handout)
- 1.15 million polygons after dissolve

Potential Historic Vegetation from Ecological Land Types Applied to Objects



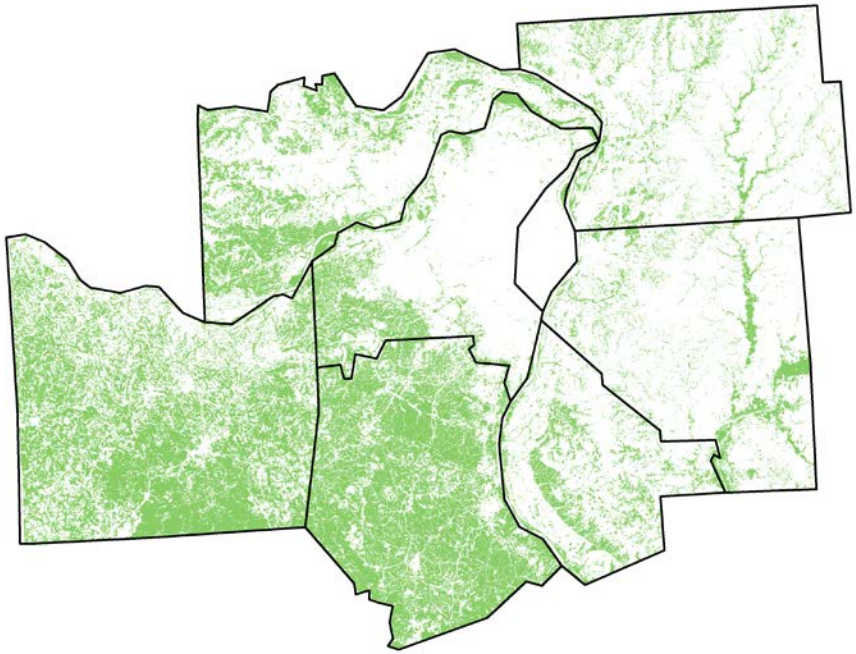

1 Urban and Crop Land
2 Cultural/Disturbance Vegetation
3 Natural and Semi-natural Vegetation
4 Special Communities
0 Open Water

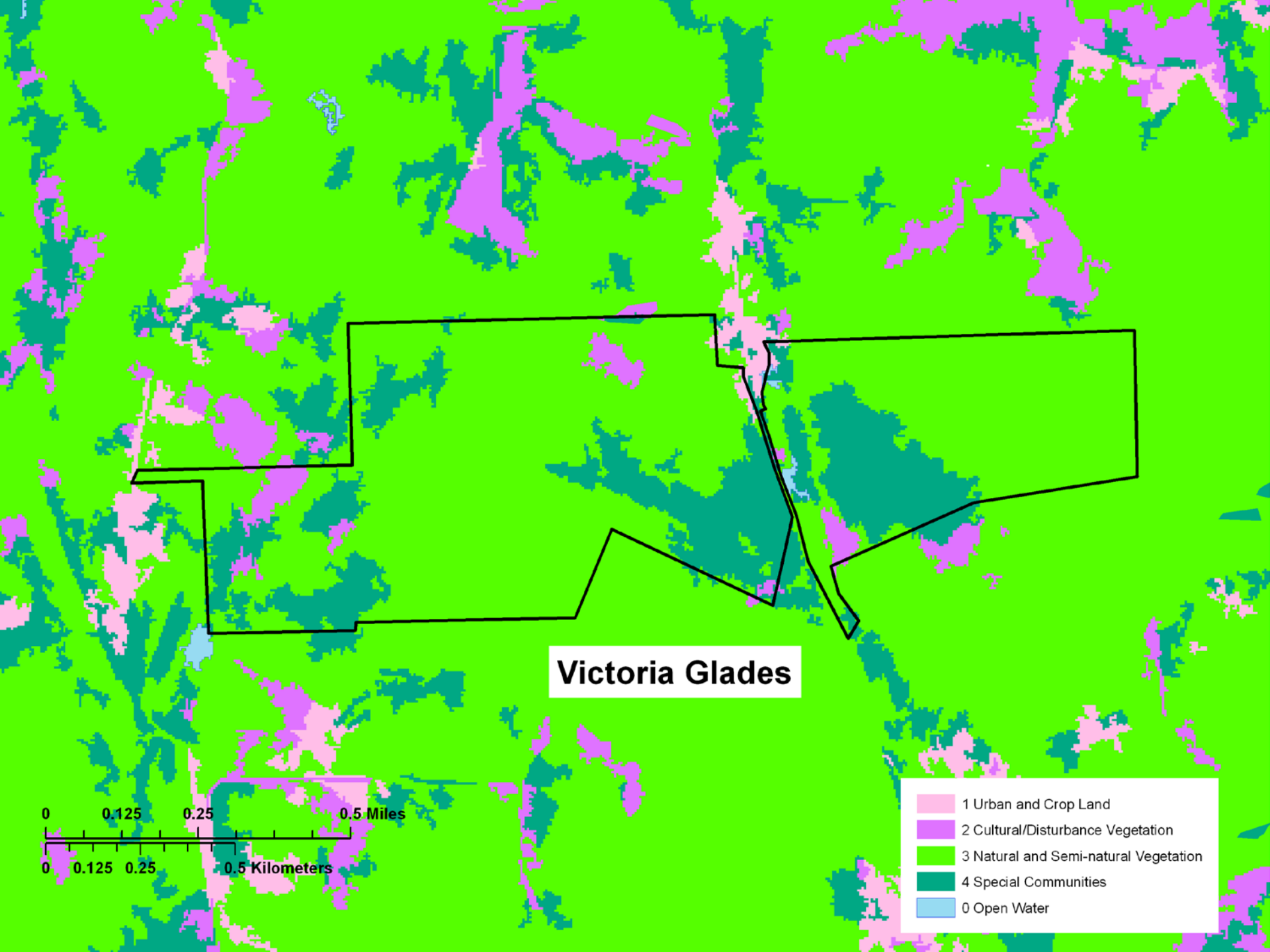
Presentation Outline

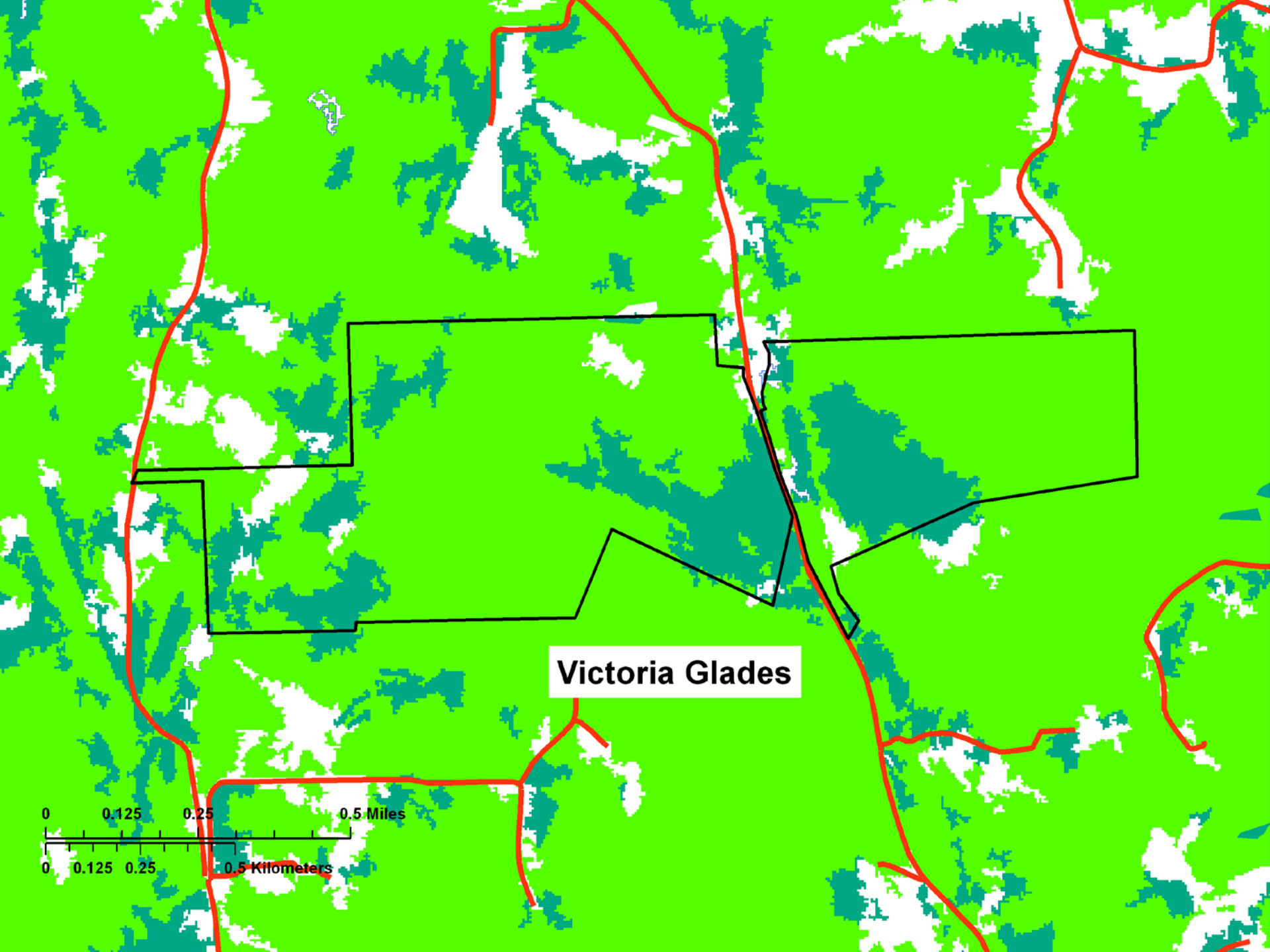
- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

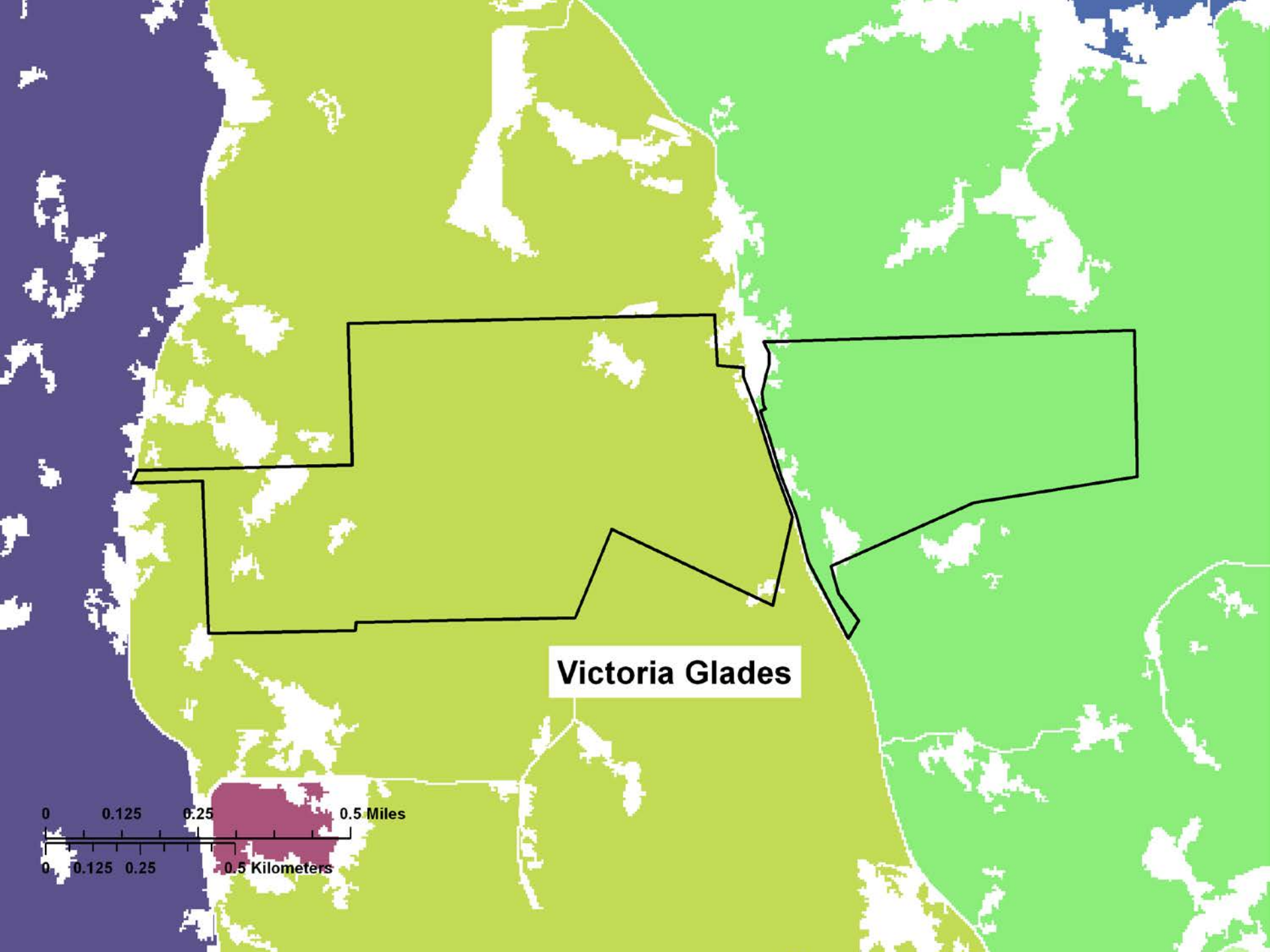
Development of Patches

- Categorize current vegetation
- Aggregate Condition 3 & 4
- Clip polygons with roads
- Cut largest polygon into 3 patches
- 23,578 total patches



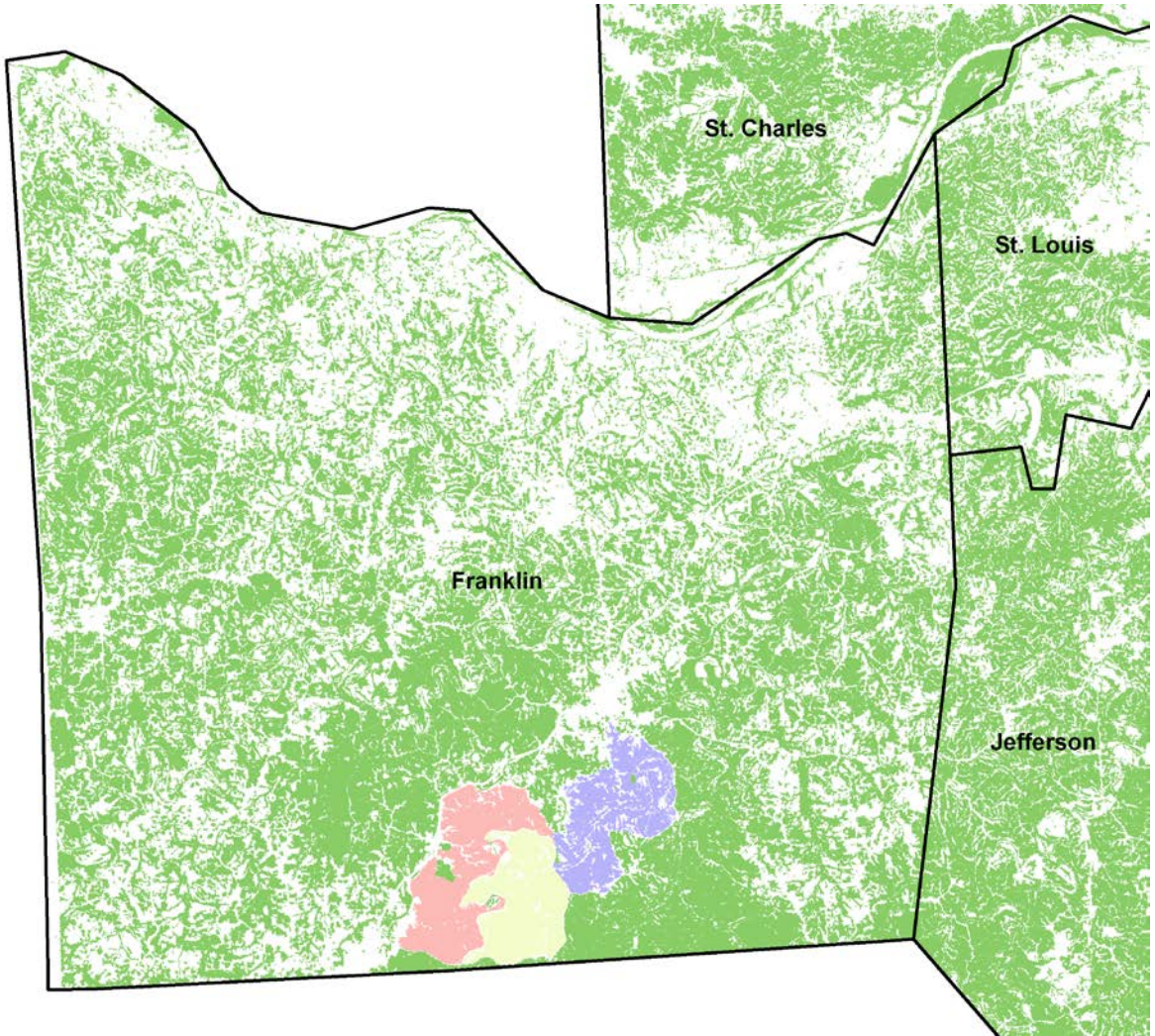

Victoria Glades
0
0.125
0.25
0.5 Miles
0
0.125
0.25
0.5 Kilometers
1 Urban and Crop Land
2 Cultural/Disturbance Vegetation
3 Natural and Semi-natural Vegetation
4 Special Communities
0 Open Water


Victoria Glades
0
0.125
0.25
0.5 Miles
0
0.125
0.25
0.5 Kilometers


Victoria Glades
0
0.125
0.25
0.5 Miles
0
0.125
0.25
0.5 Kilometers

Cut largest polygon into 3

- Largest patch was over 10,000 hectares
- Divided along streams



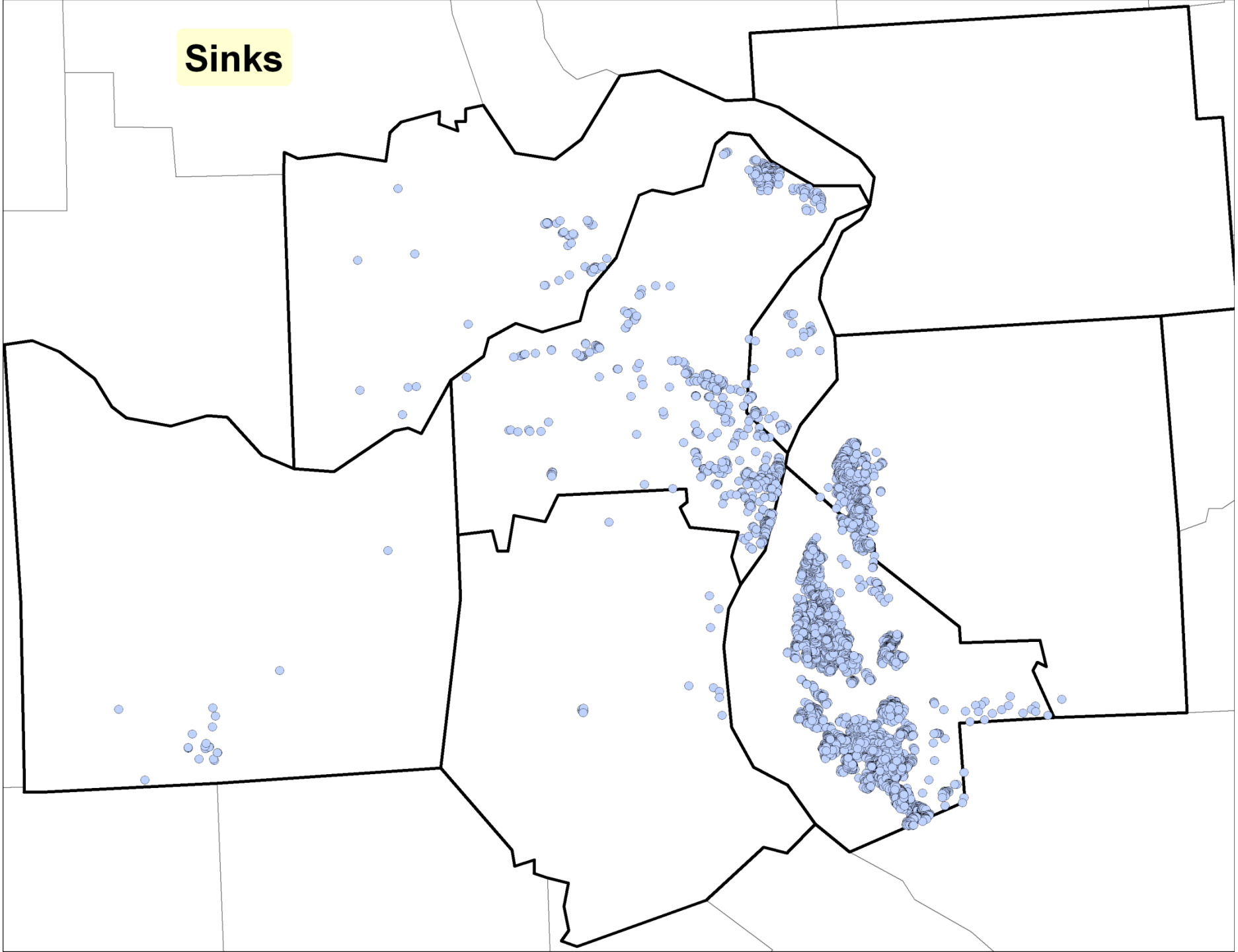
Presentation Outline

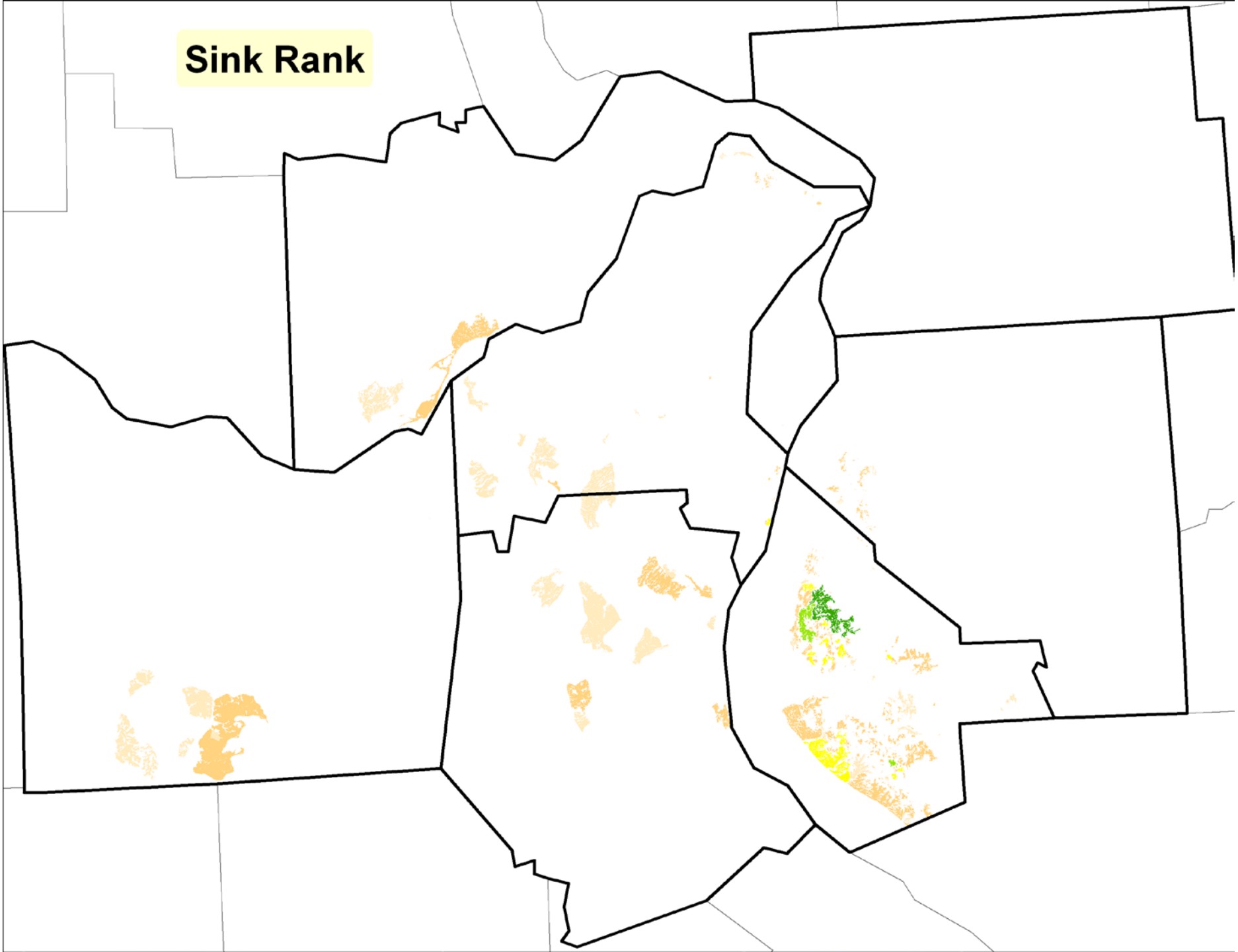
- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

Attribution of Patches

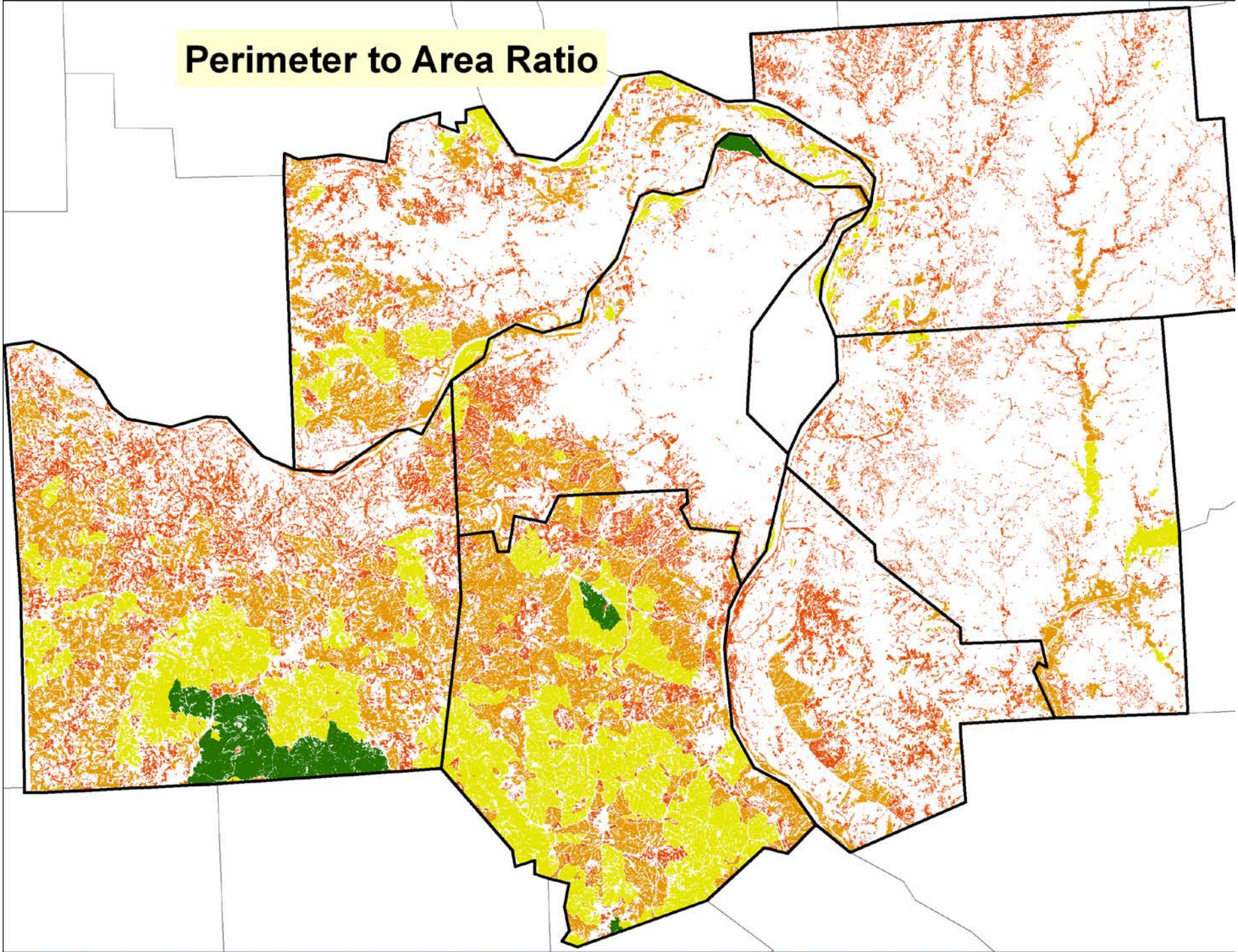
- Sinks
- Patch size
- Perimeter to area ratio
- Area of special communities
- Springs
- Area of public lands
- Area of large forest patches
- Species element count
- Total EOR's
- G1 & G2 elements
- Karst EOR's

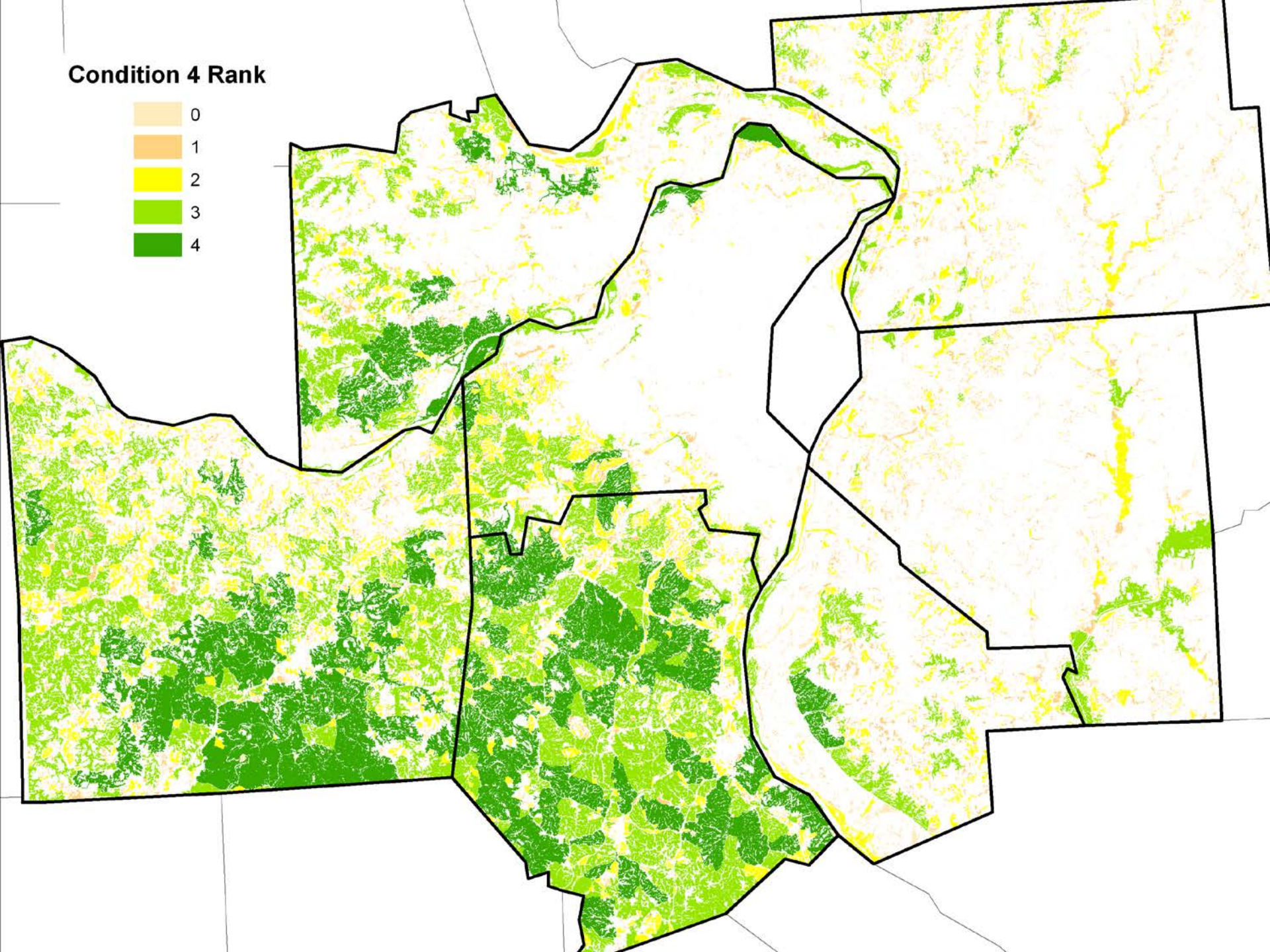
All ranked 1-5

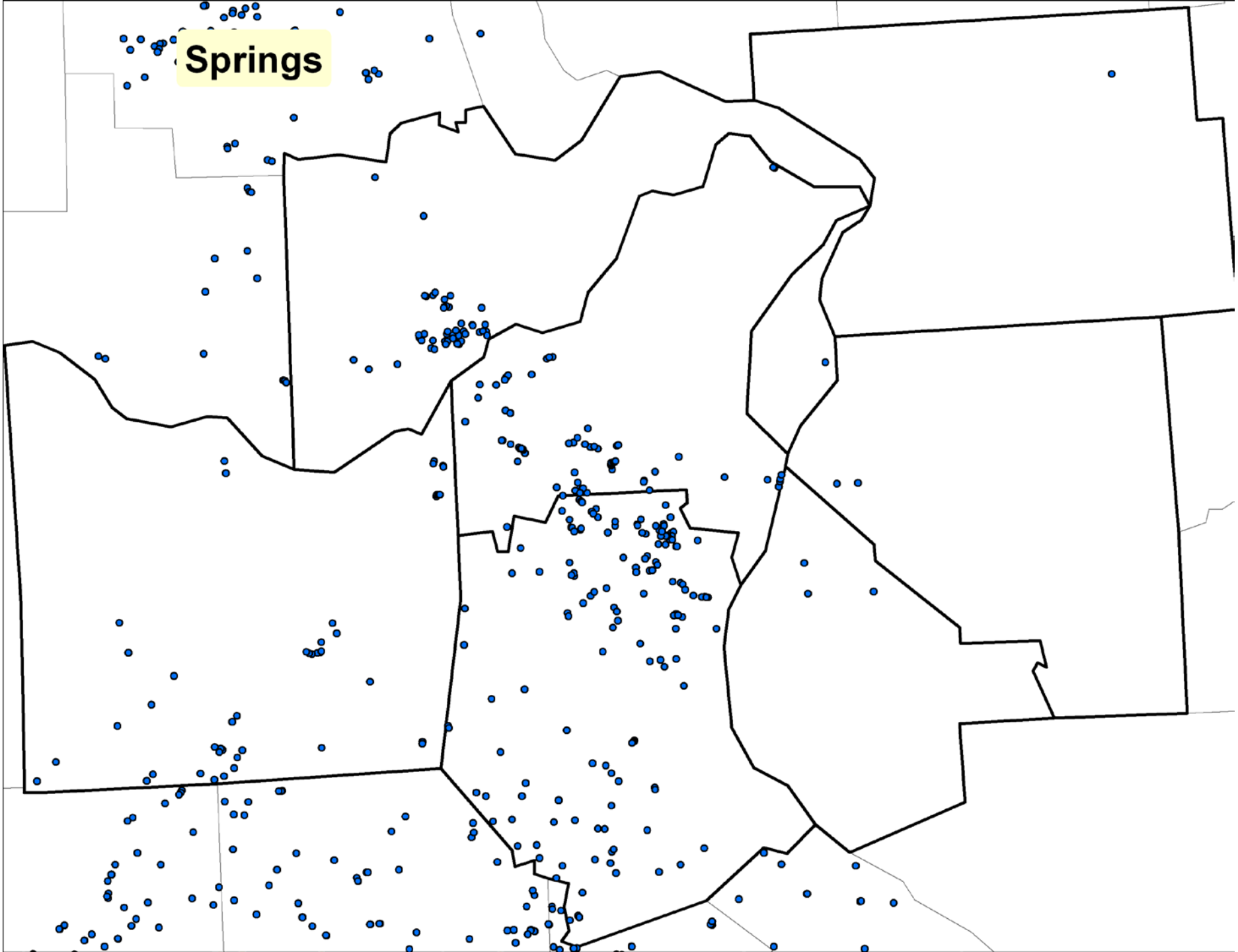

Sinks


Sink Rank

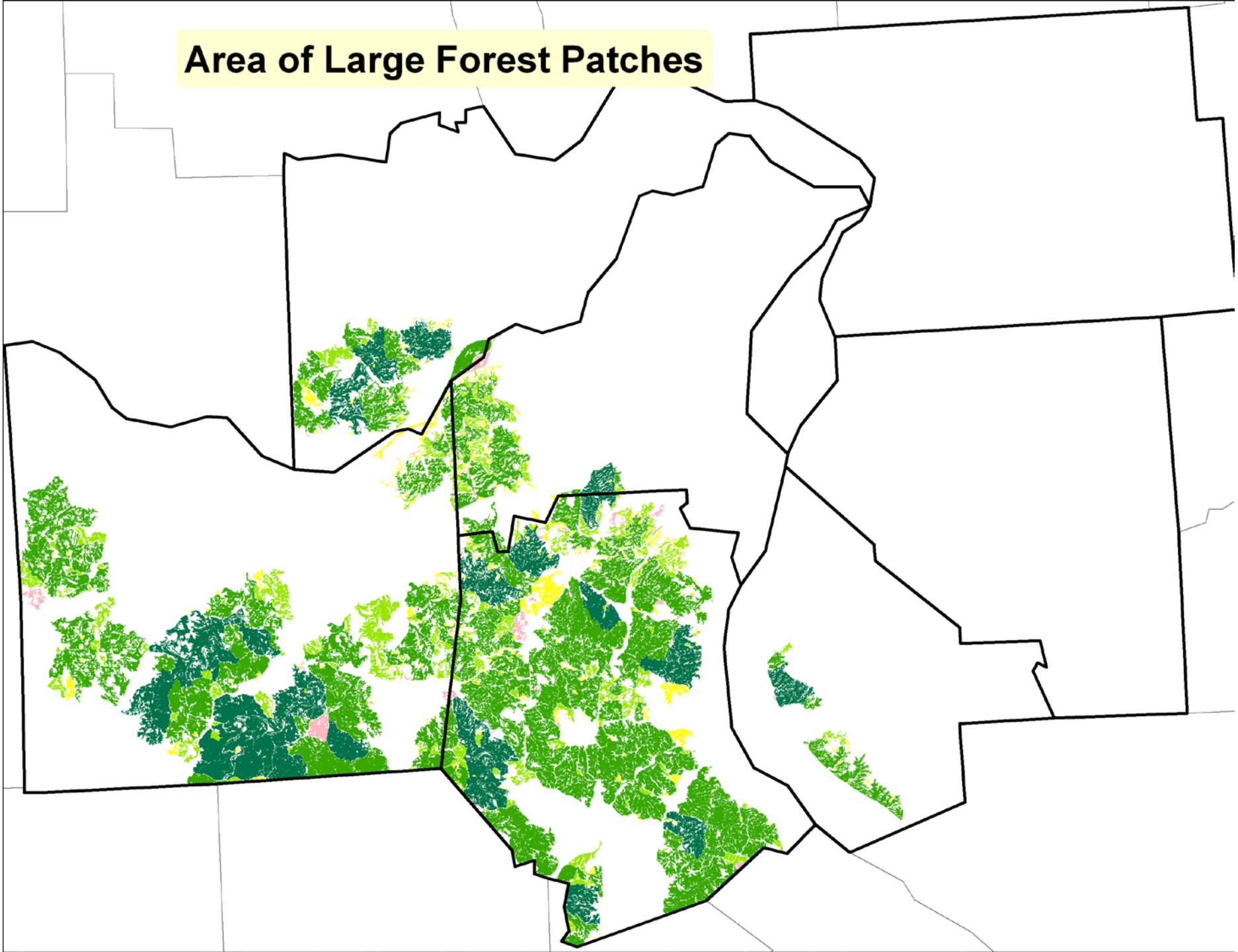
Perimeter to Area Ratio



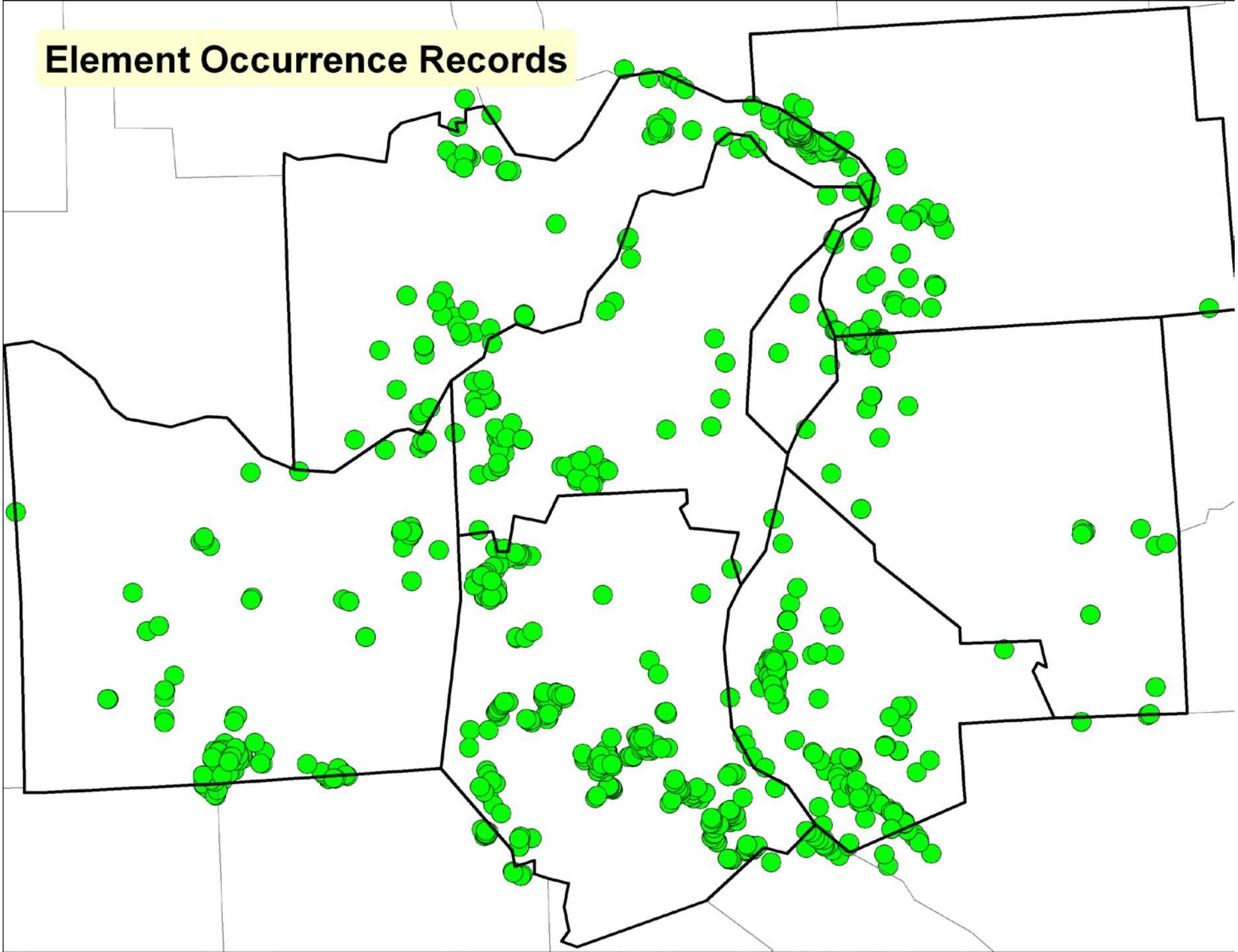

Condition 4 Rank
0
1
2
3
4


Springs

Area of Large Forest Patches



Element Occurrence Records



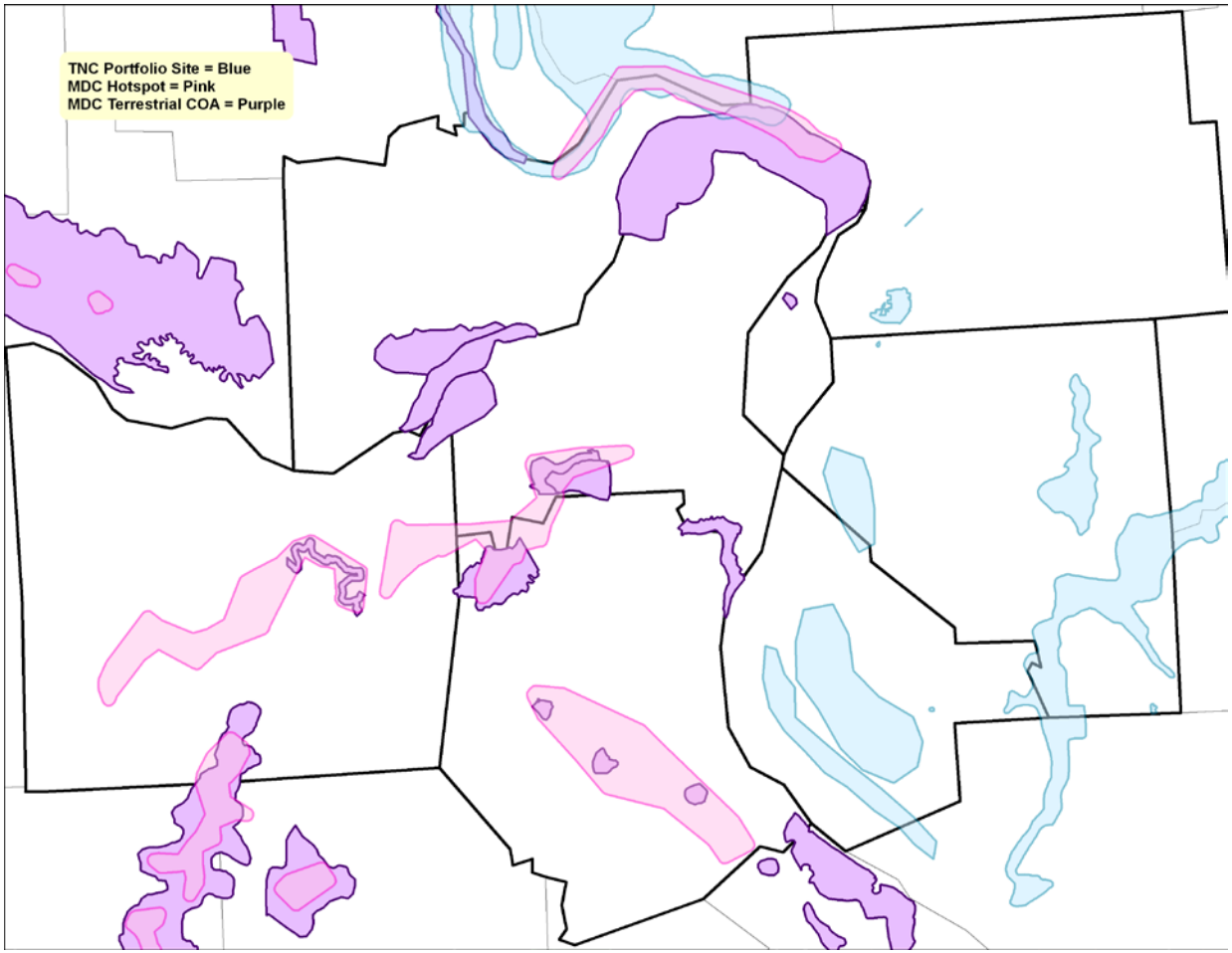
Presentation Outline

- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

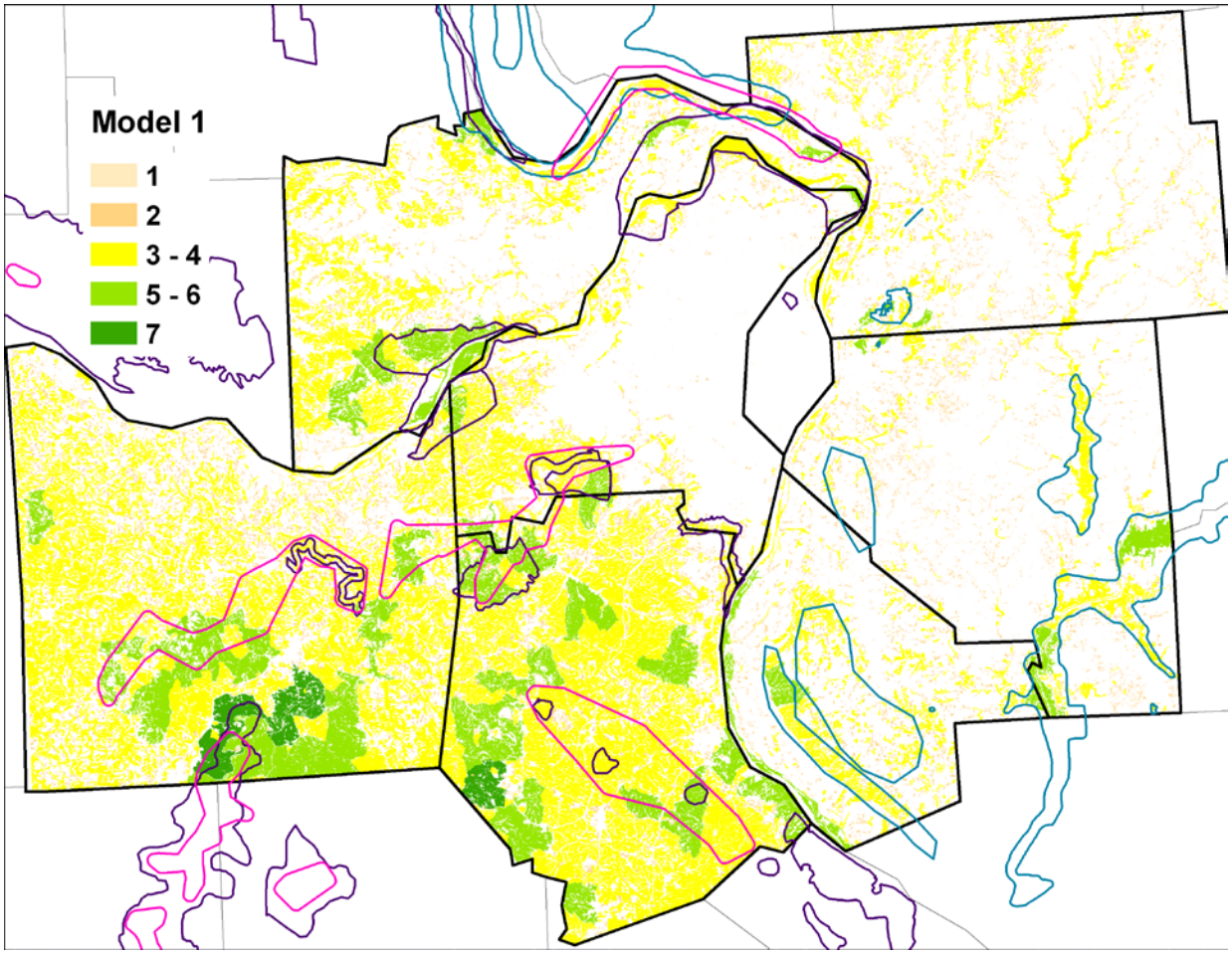
TNC Portfolio Site = Blue

MDC Hotspot = Pink

MDC Terrestrial COA = Purple

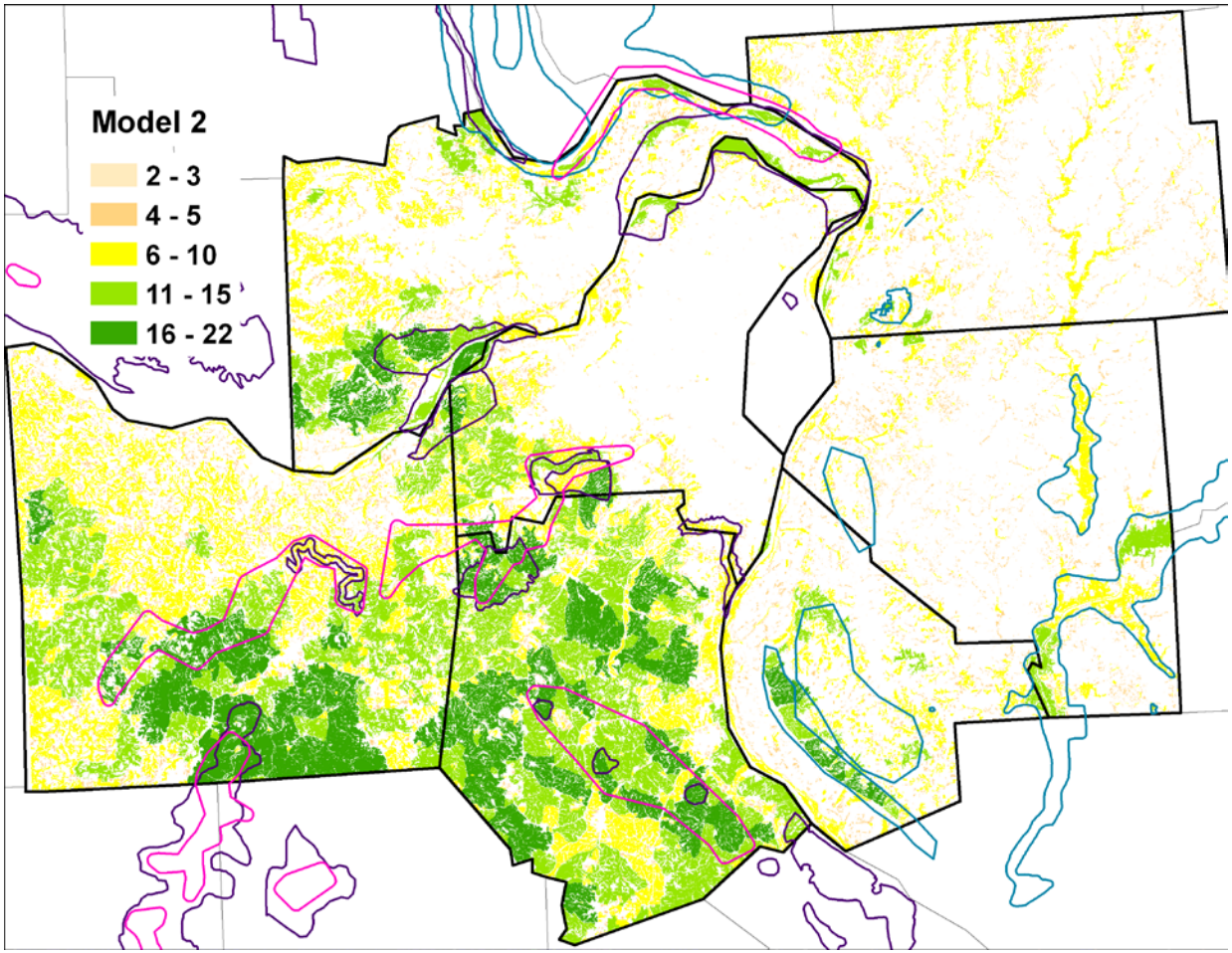


Model 1 = G1G2ELCNT + size_rank



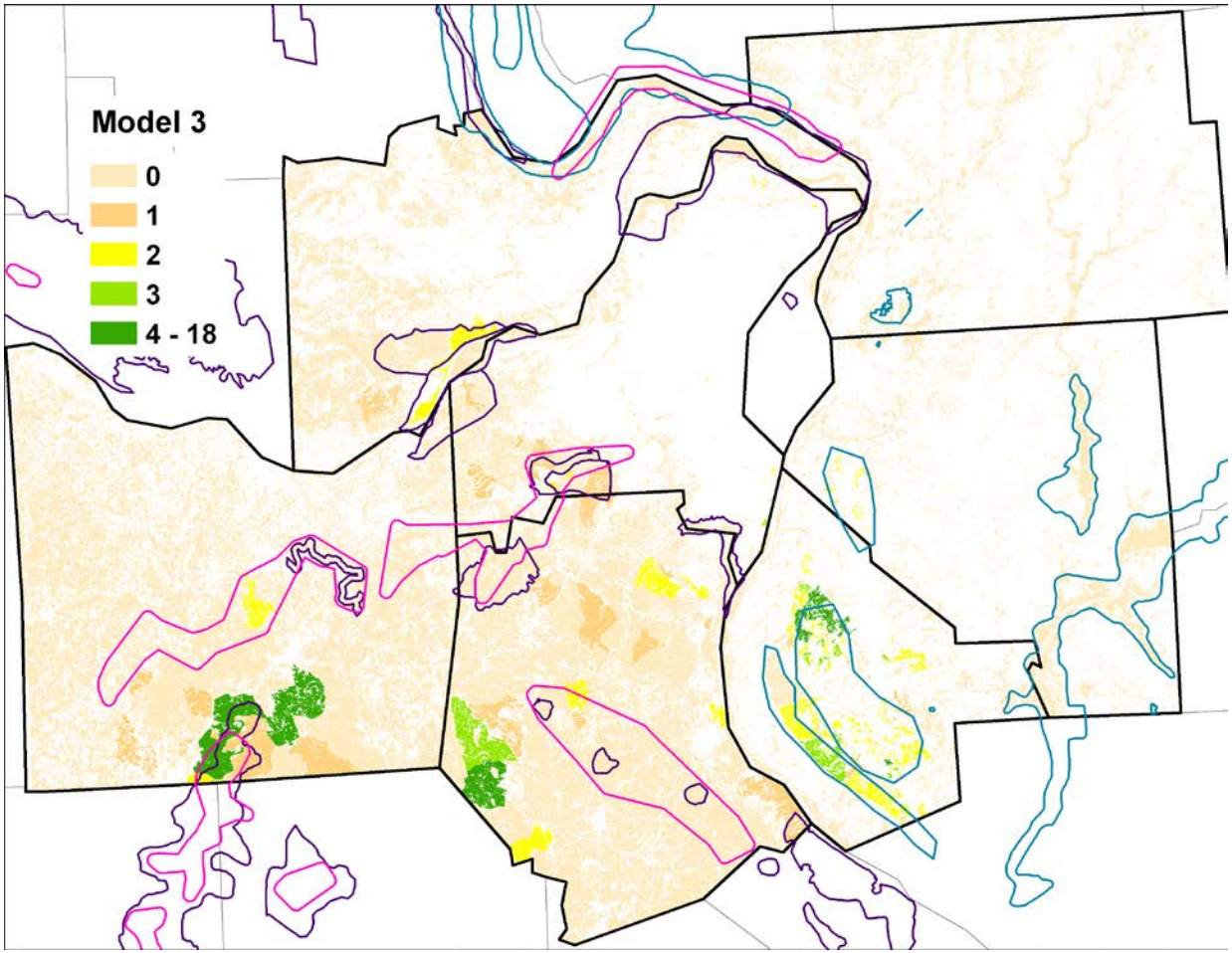
3 polygons in dark green

Model 2 = G1G2ELCNT + size_rank + sink_rank + per_area_rank + depart4_rank + for2000_rank



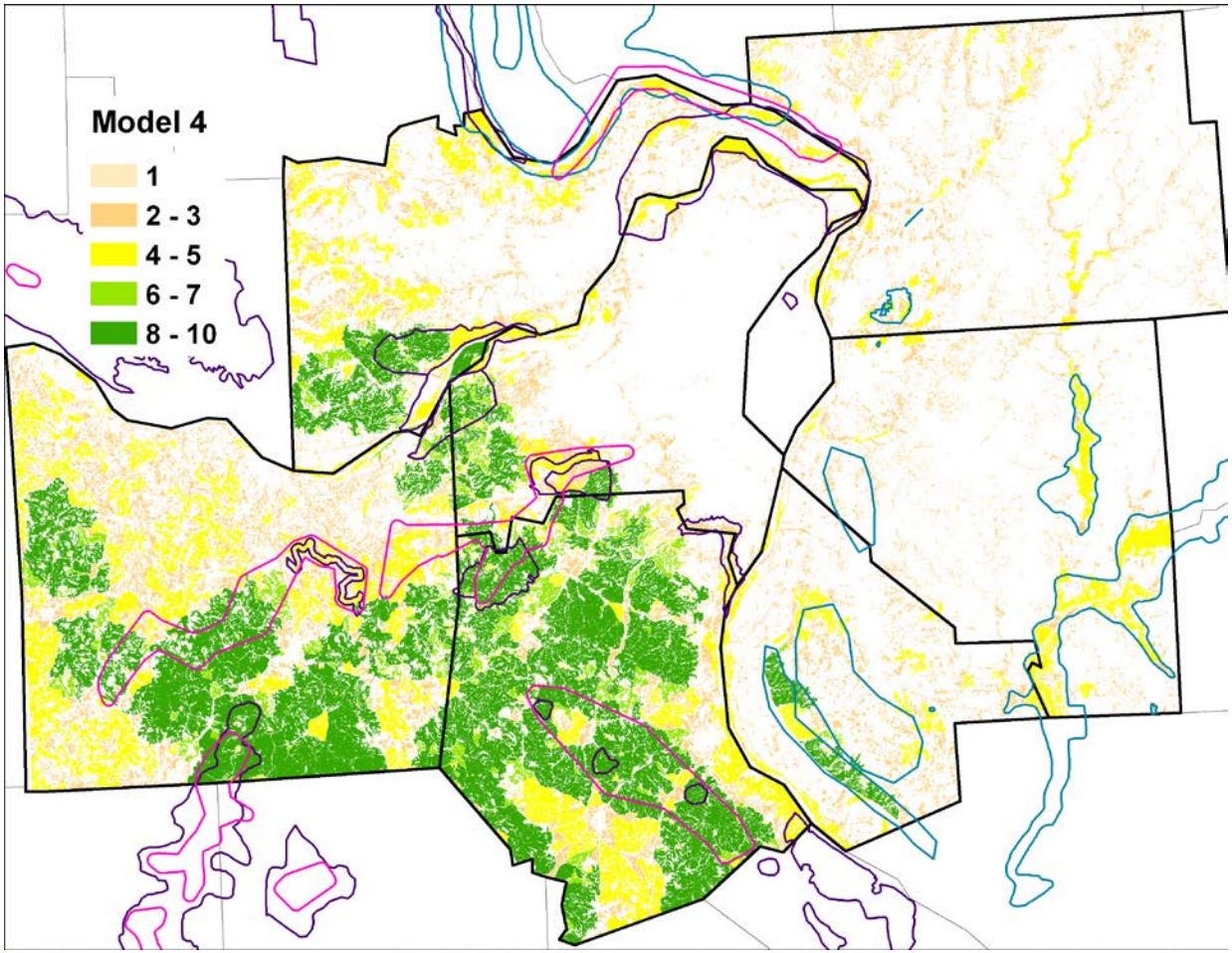
77 polygons in dark green

Model 3 = KARSTSPEOR+ sink_rank



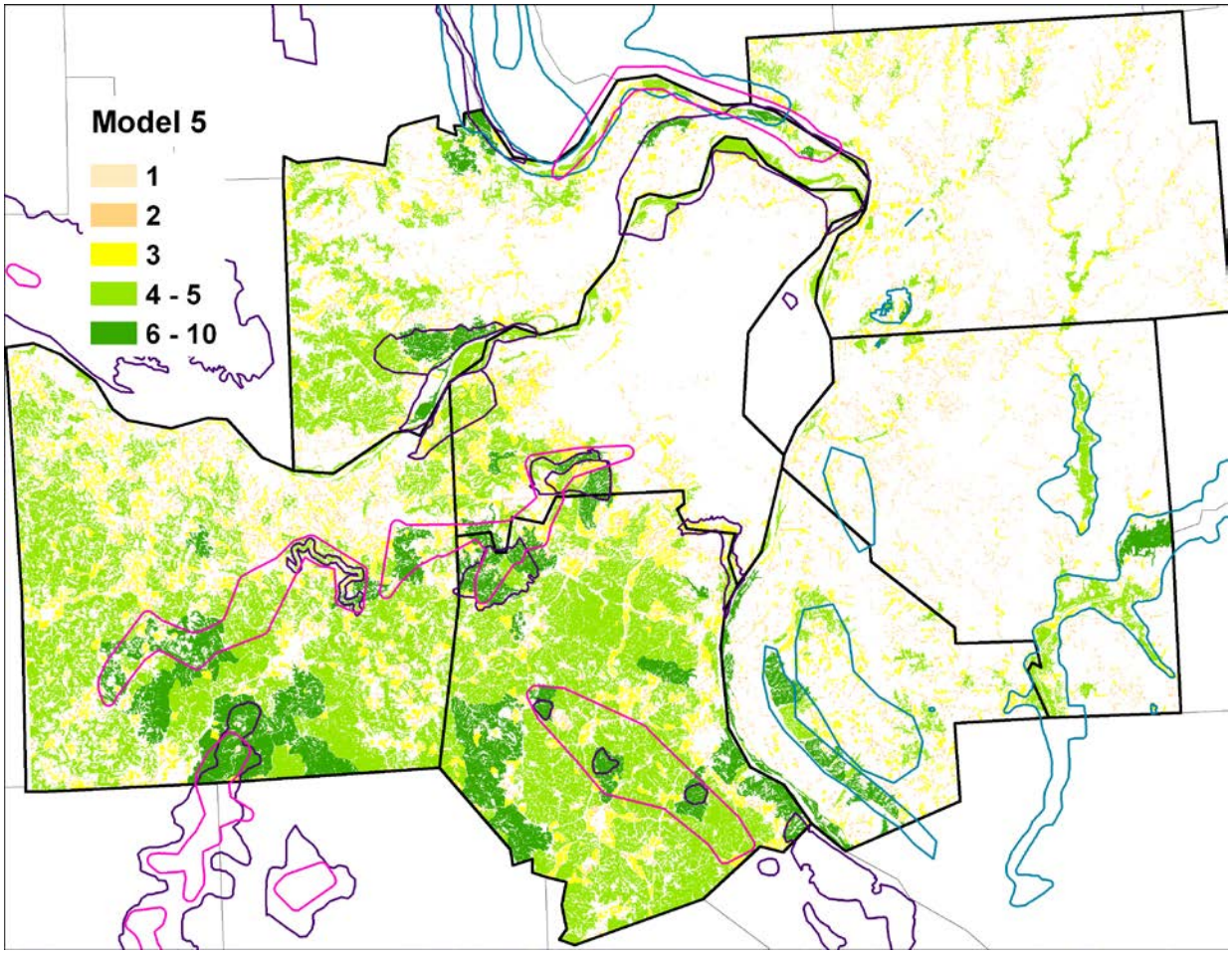
7 polygons in dark green

Model 4 = size_rank + per_area_rank + for2000_rank



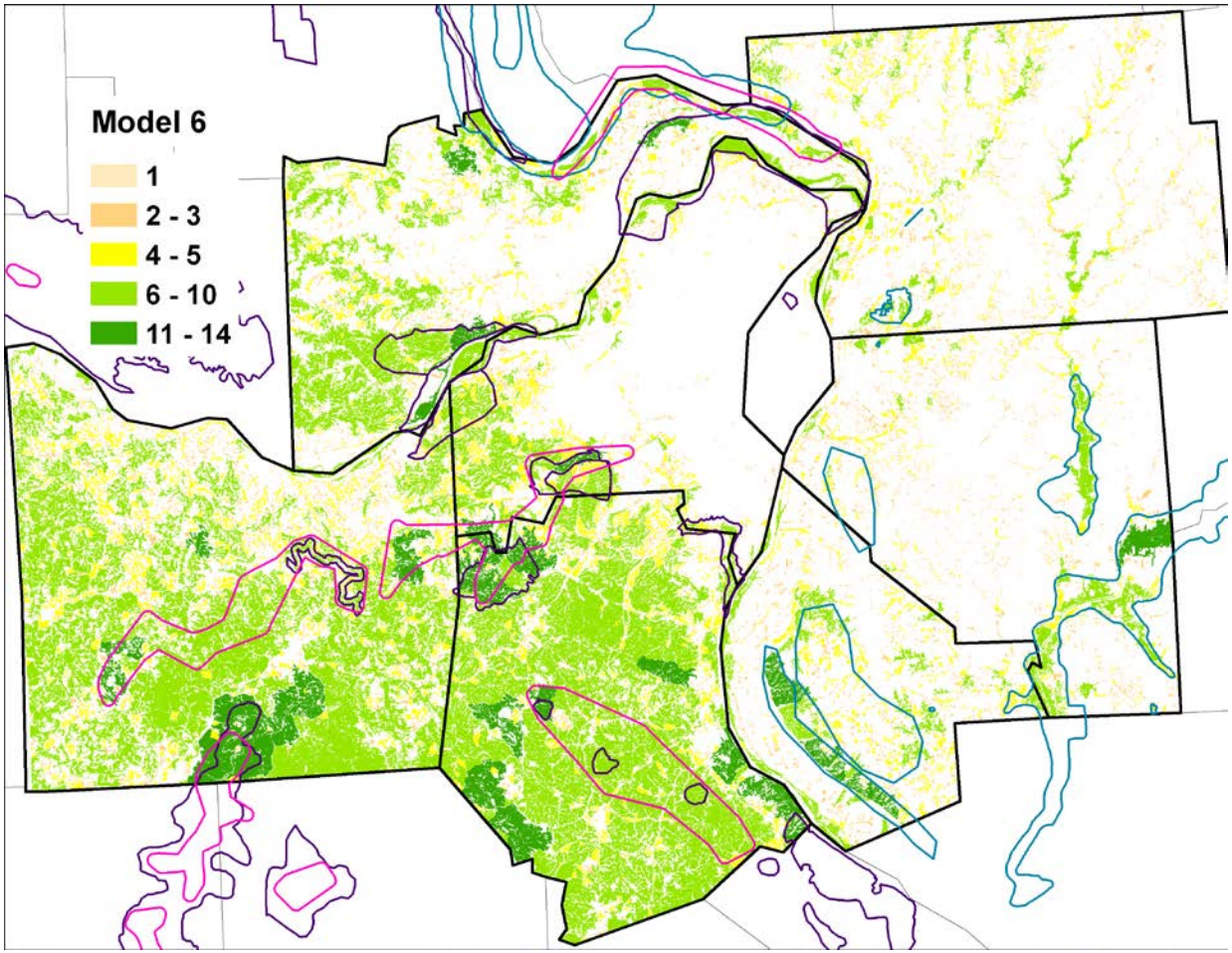
249 polygons in dark green

Model 5 = sp_el_rank + size_rank



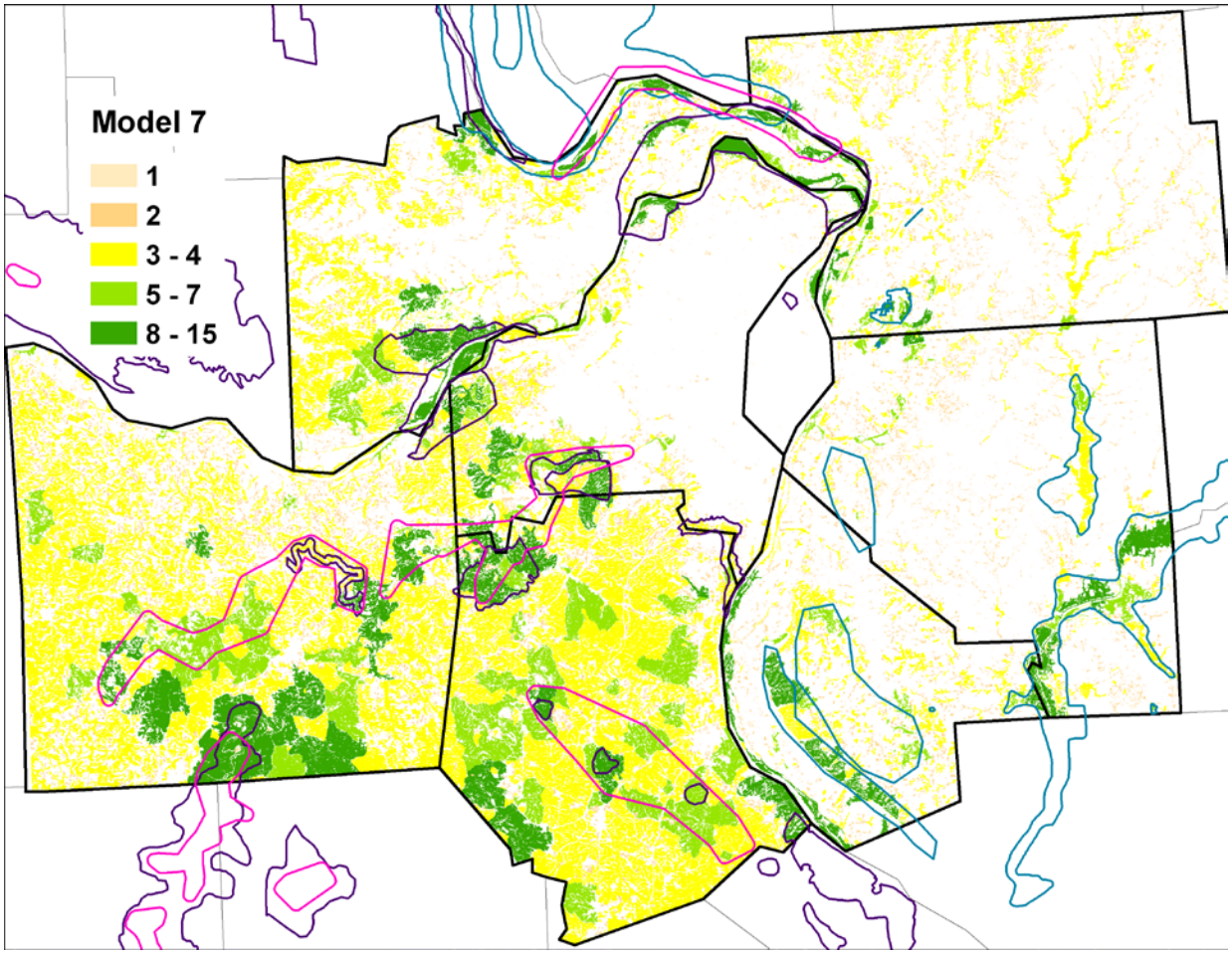
55 polygons in dark green

Model 6 = sp_el_rank + size_rank + depart4_rank



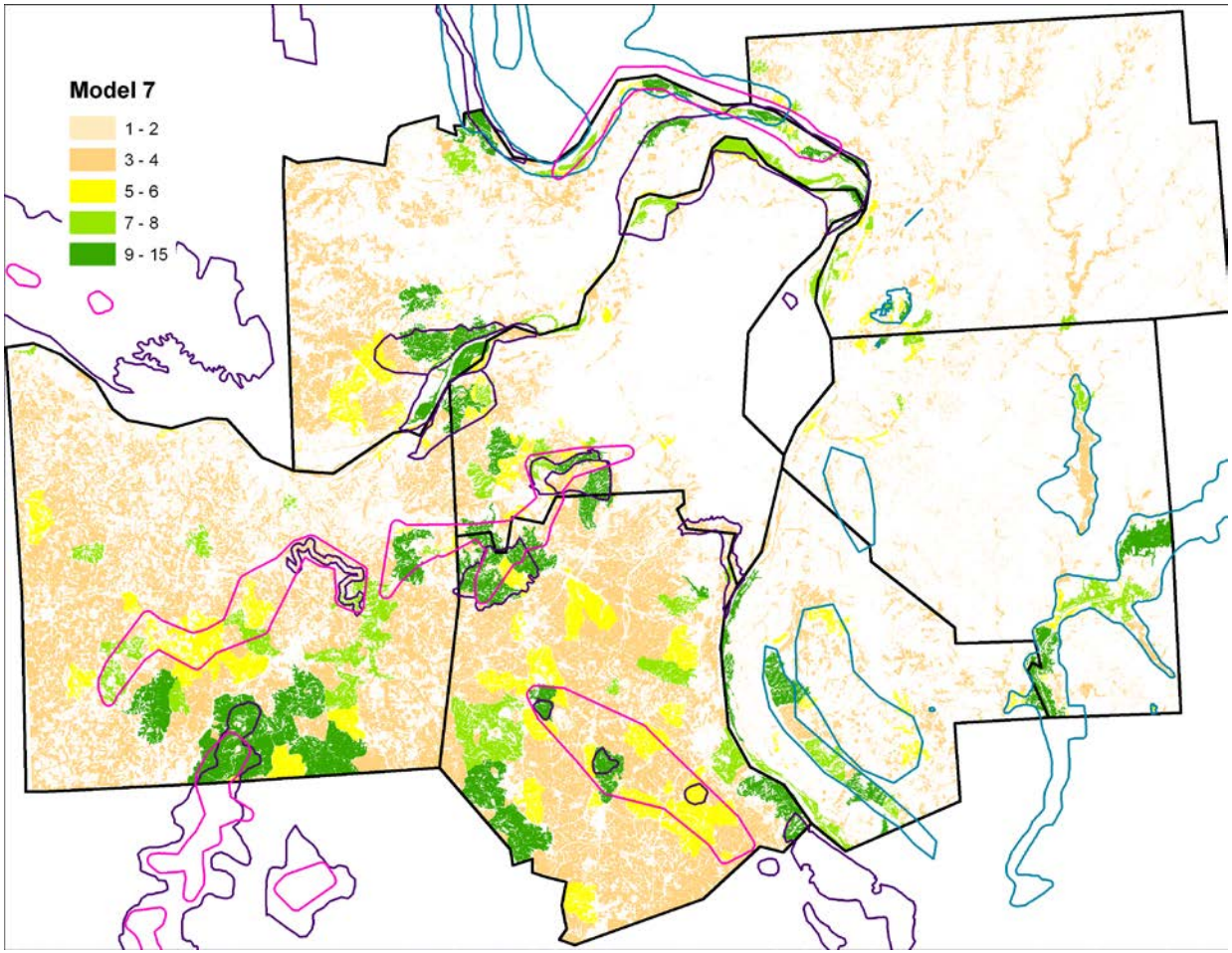
29 polygons in dark green

Model 7 = sp_el_rank + size_rank + publand_rank



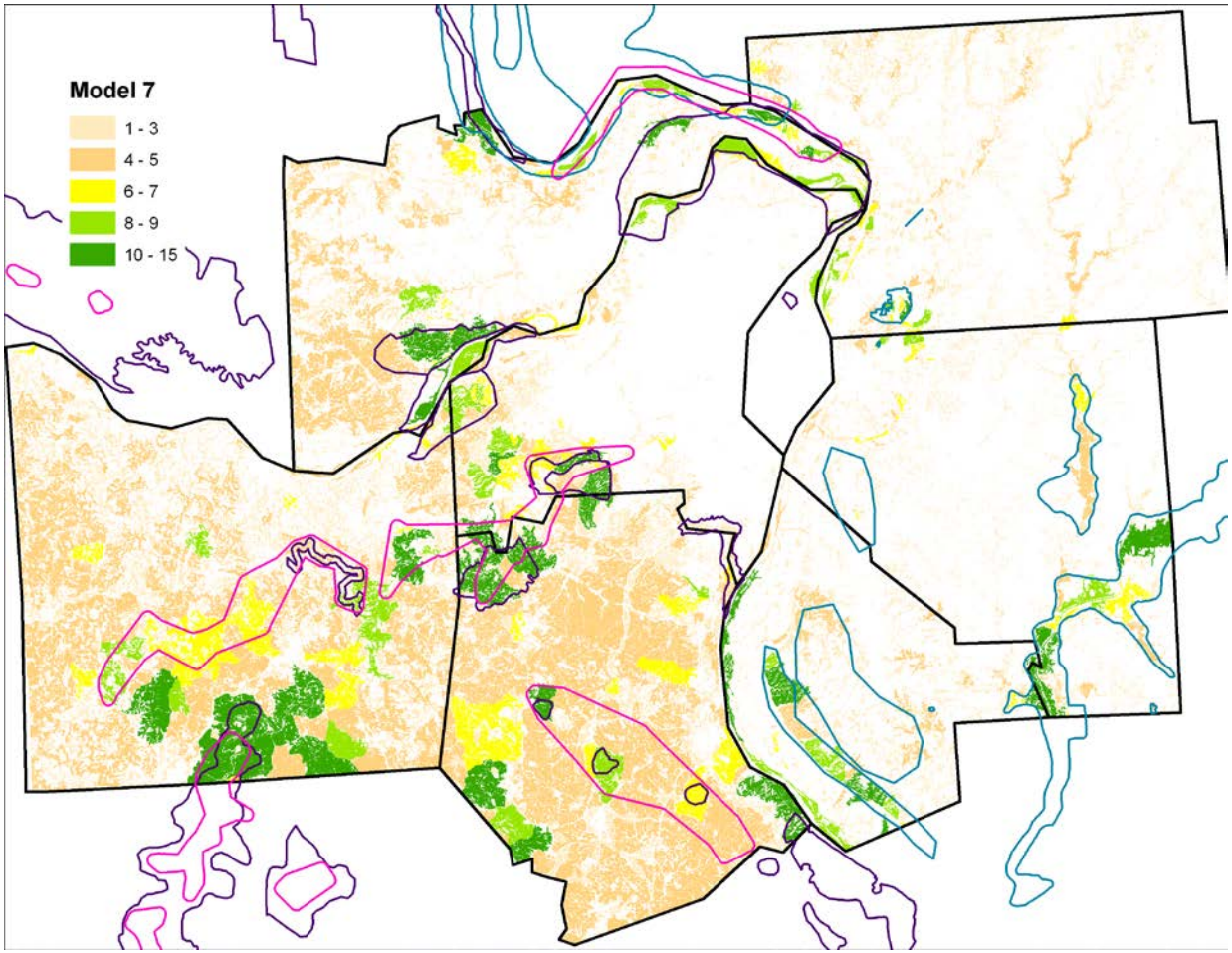
75 polygons in dark green

Model 7 (evens)



47 polygons in dark green

Model 7 (odds)

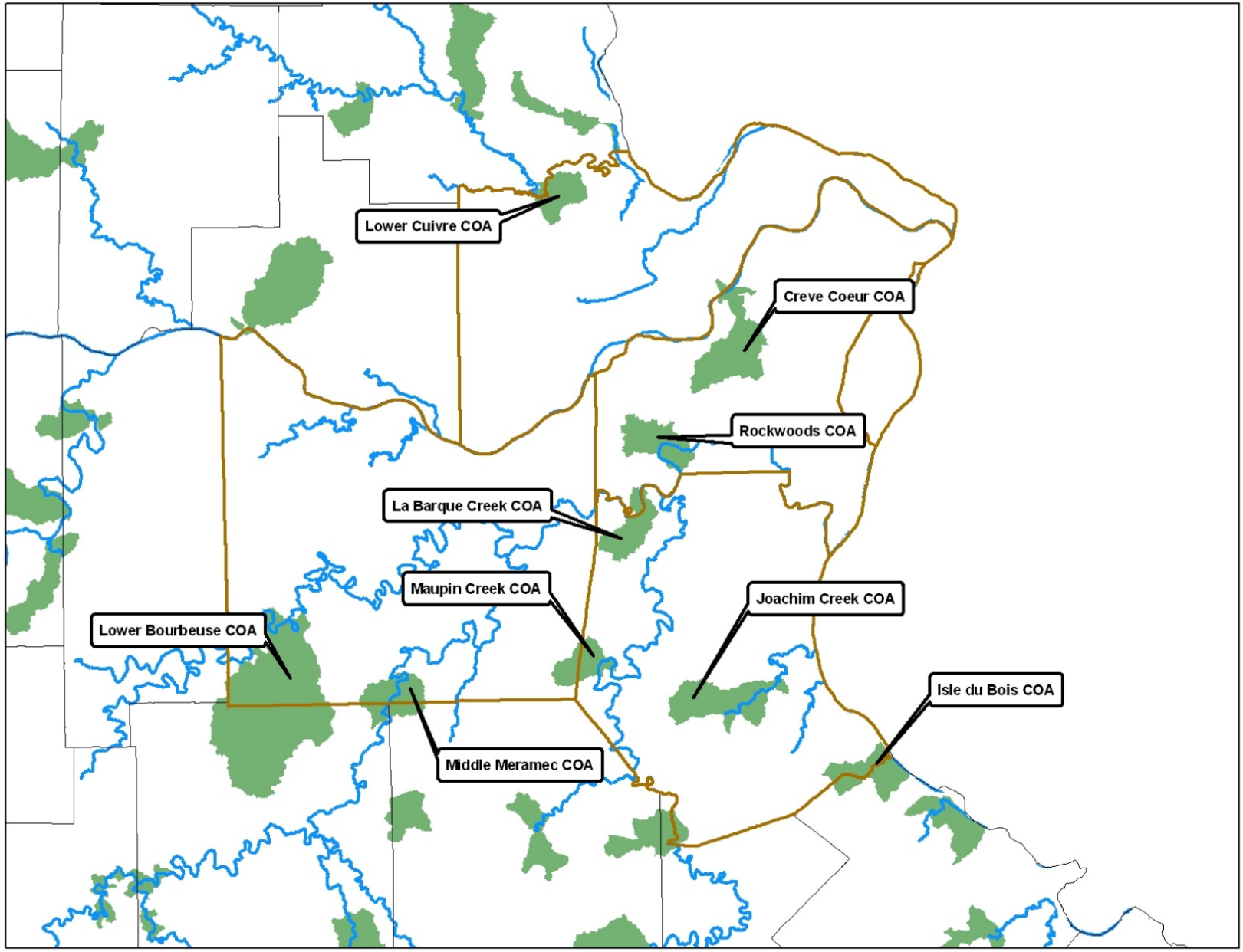


31 polygons in dark green

Presentation Outline

- Data Layer Development
  - Land cover data from satellite imagery
  - Object creation from NAIP
  - ELT's and Ancillary Data
  - High Resolution Vegetation
- Ecological Significance Modeling
  - Development of Patches
  - Attribution of Patches
  - Model Development & Examples
  - Aquatic Models

Aquatic Conservation Opportunity Areas (COA)



Discussion

- Aquatic and Terrestrial Models are separate.
- Which terrestrial model is desired?
- What percentage area should be ranked highest?
- Other?