Creation of the Landcover and Natural Communities Database

April 6, 2012
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University of Missouri
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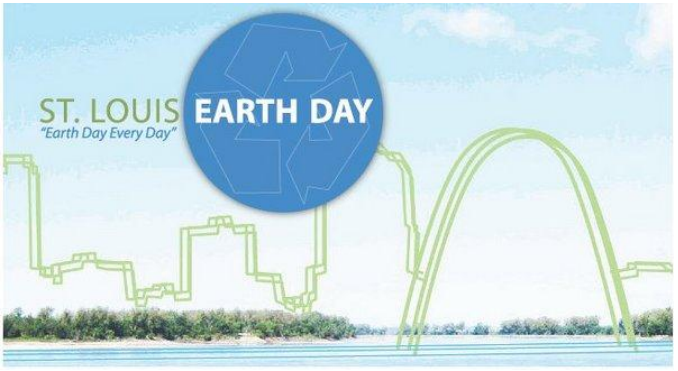
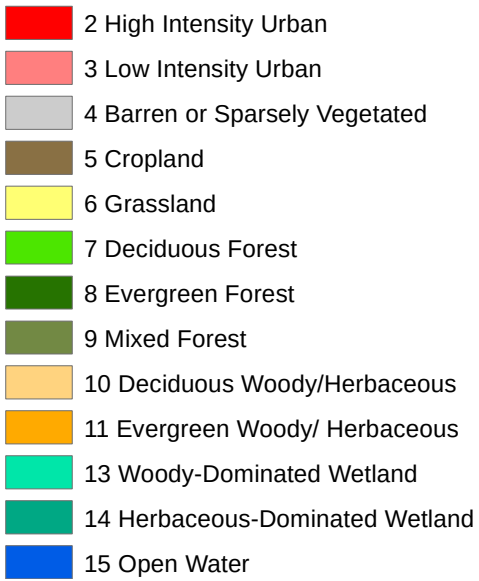


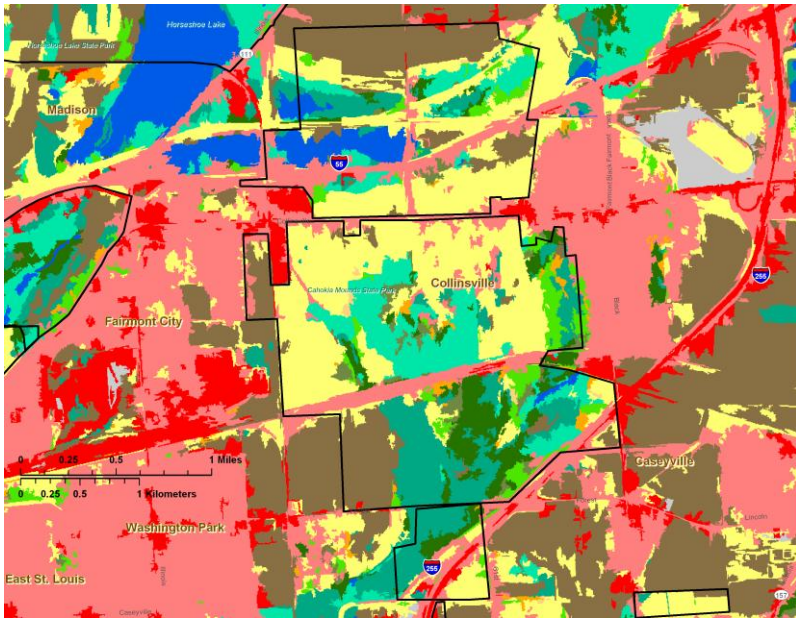
Presentation Outline

1. Vegetation Mapping
2. Regional Ecological Significance Modeling
3. Project-level Ecological Significance Modeling
4. New Work

1. Vegetation Mapping

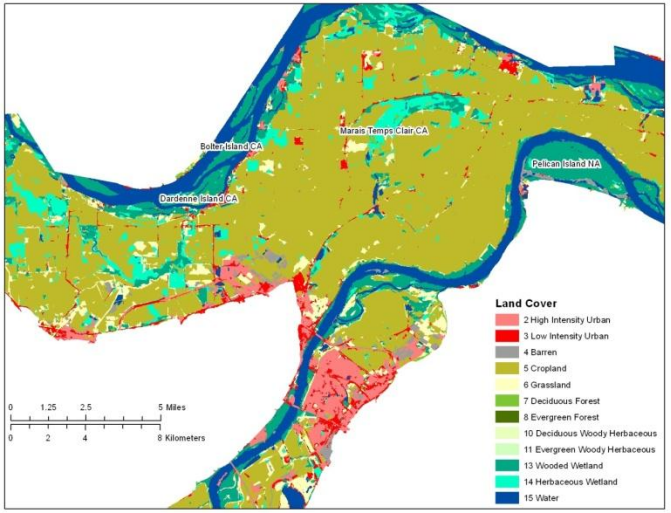
- Land cover data from satellite imagery
- Object creation from NAIP
- ELT's and Ancillary Data
- High Resolution Vegetation

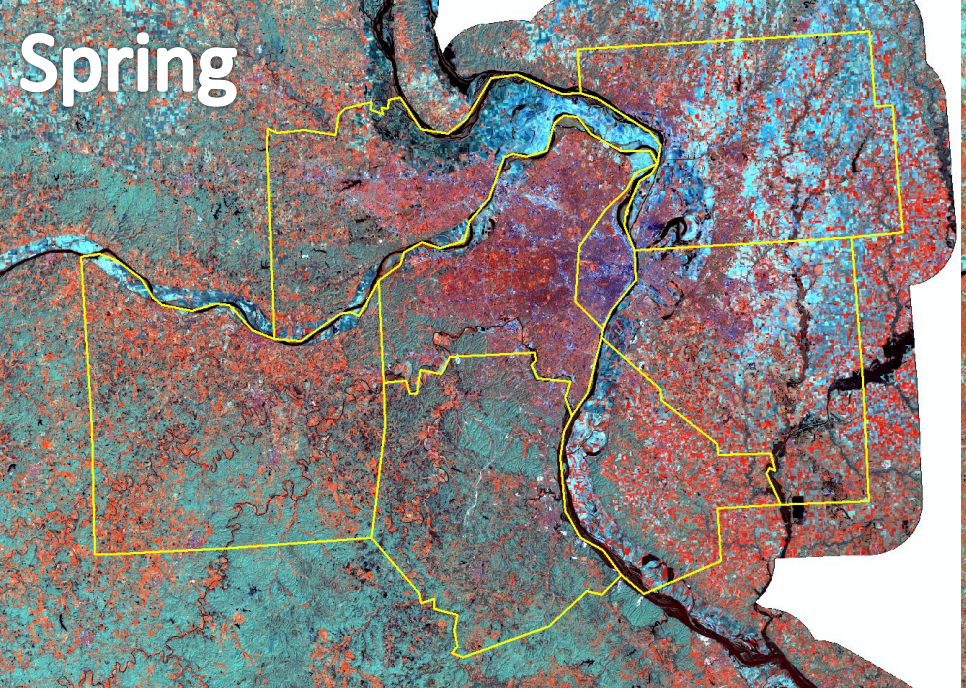


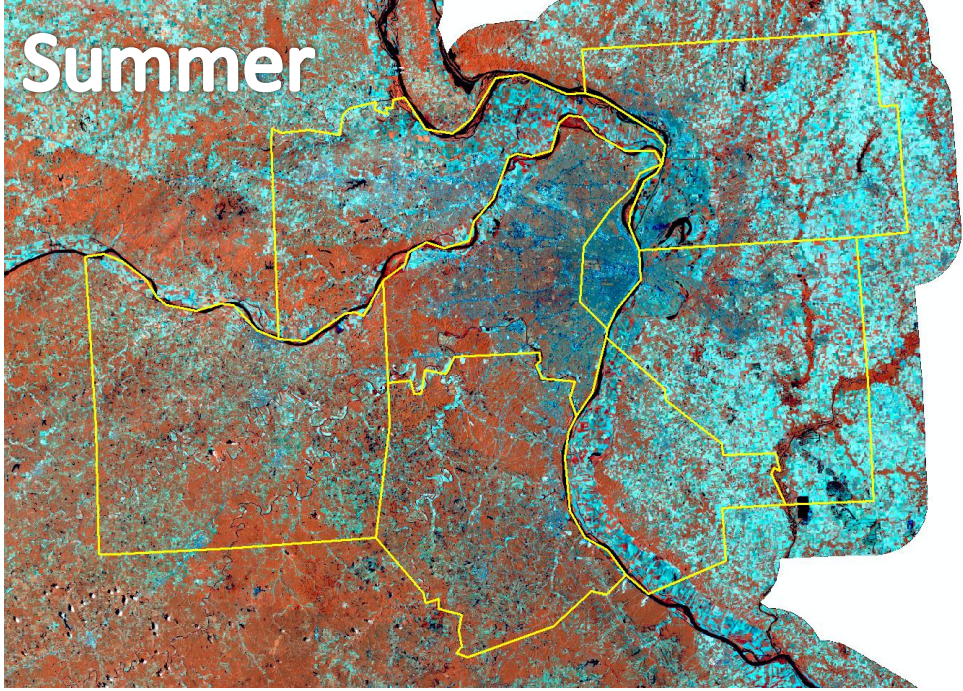


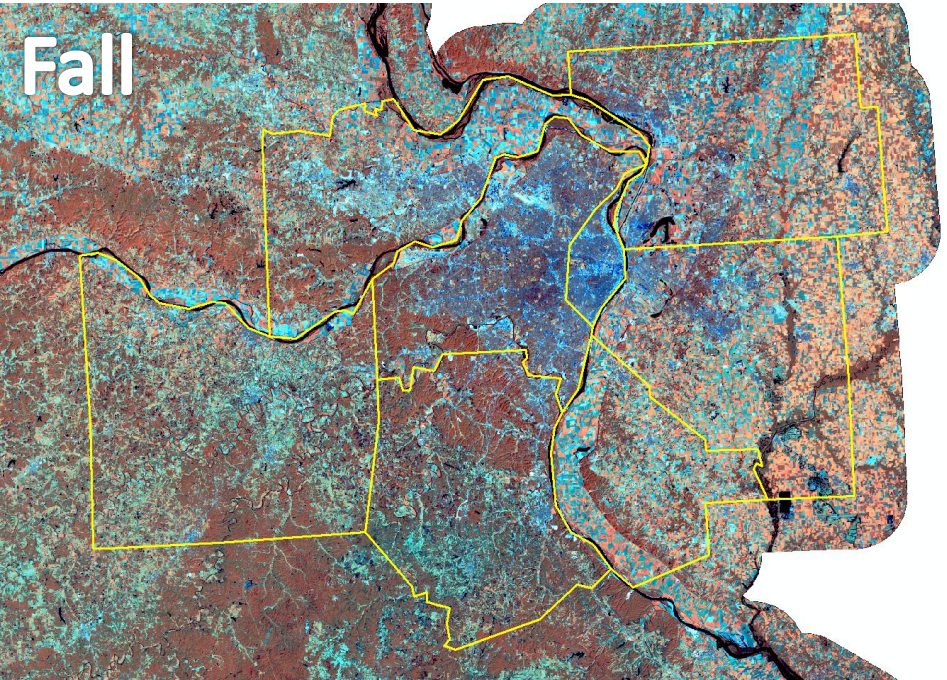
Land cover data from satellite imagery

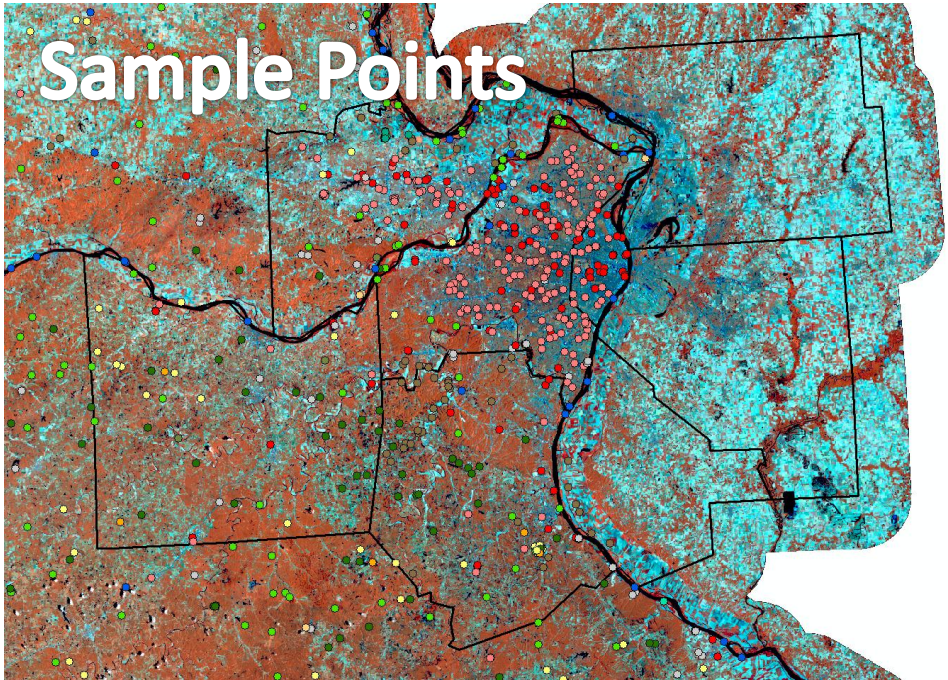
- Three date (spring, summer, fall)
- Abiotic data (slope, aspect, landscape position, solar insolation, % canopy, % impervious, cropland, alluvium)
- Sample points from previous landcover
- Verified with NAIP imagery
- See5 classifier

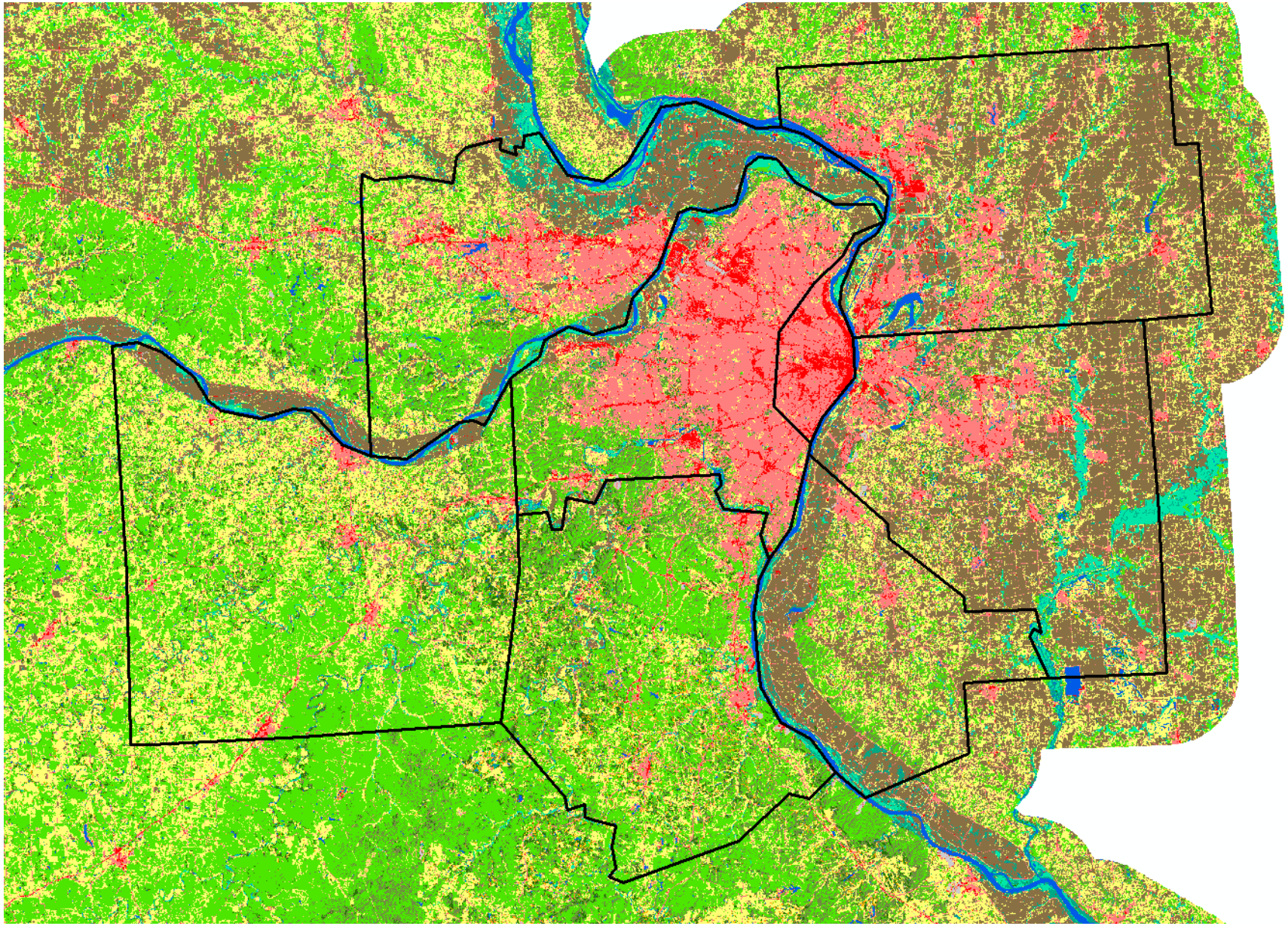



Spring


Summer


Fall


Sample Points



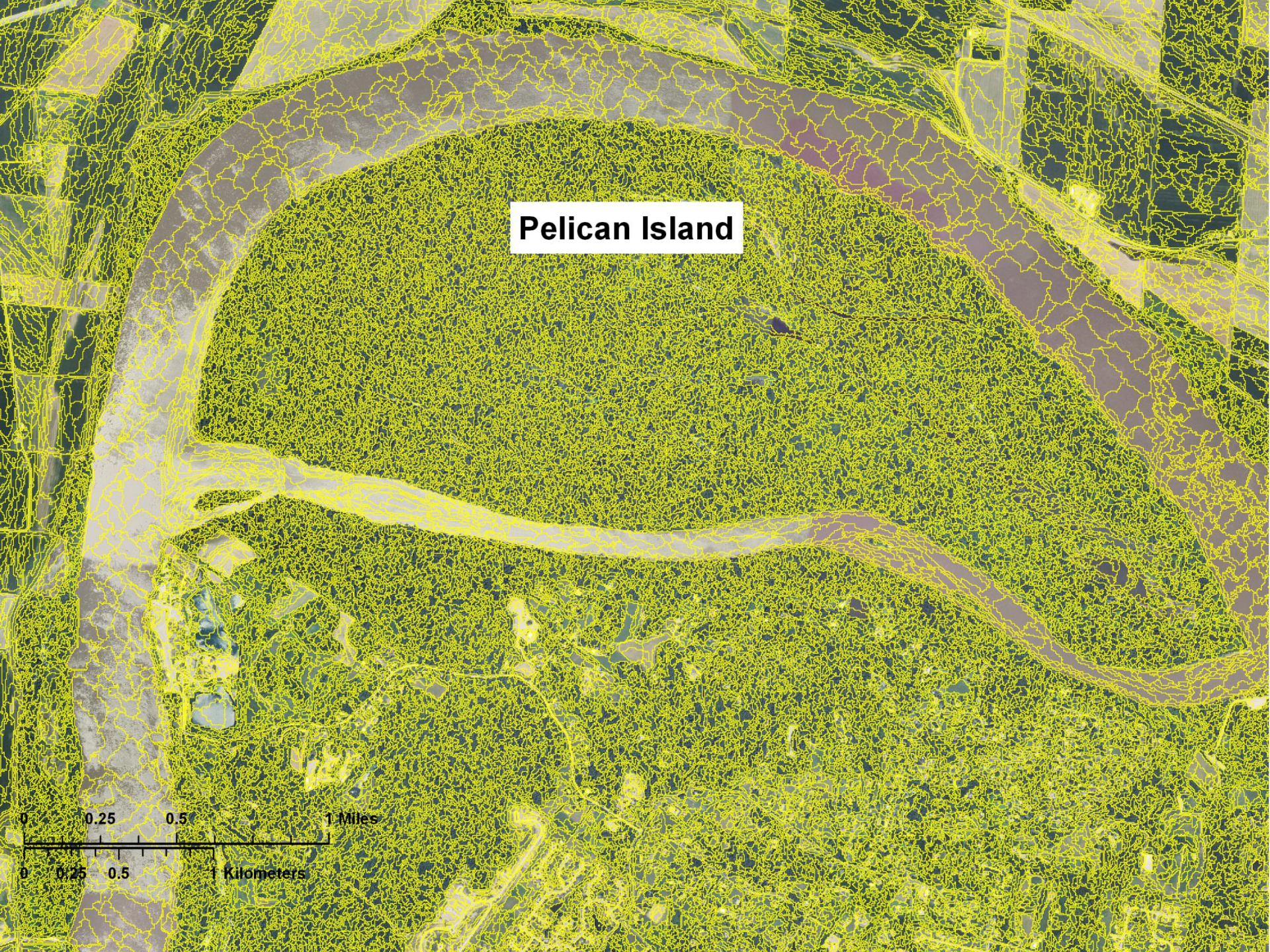
Object creation from NAIP

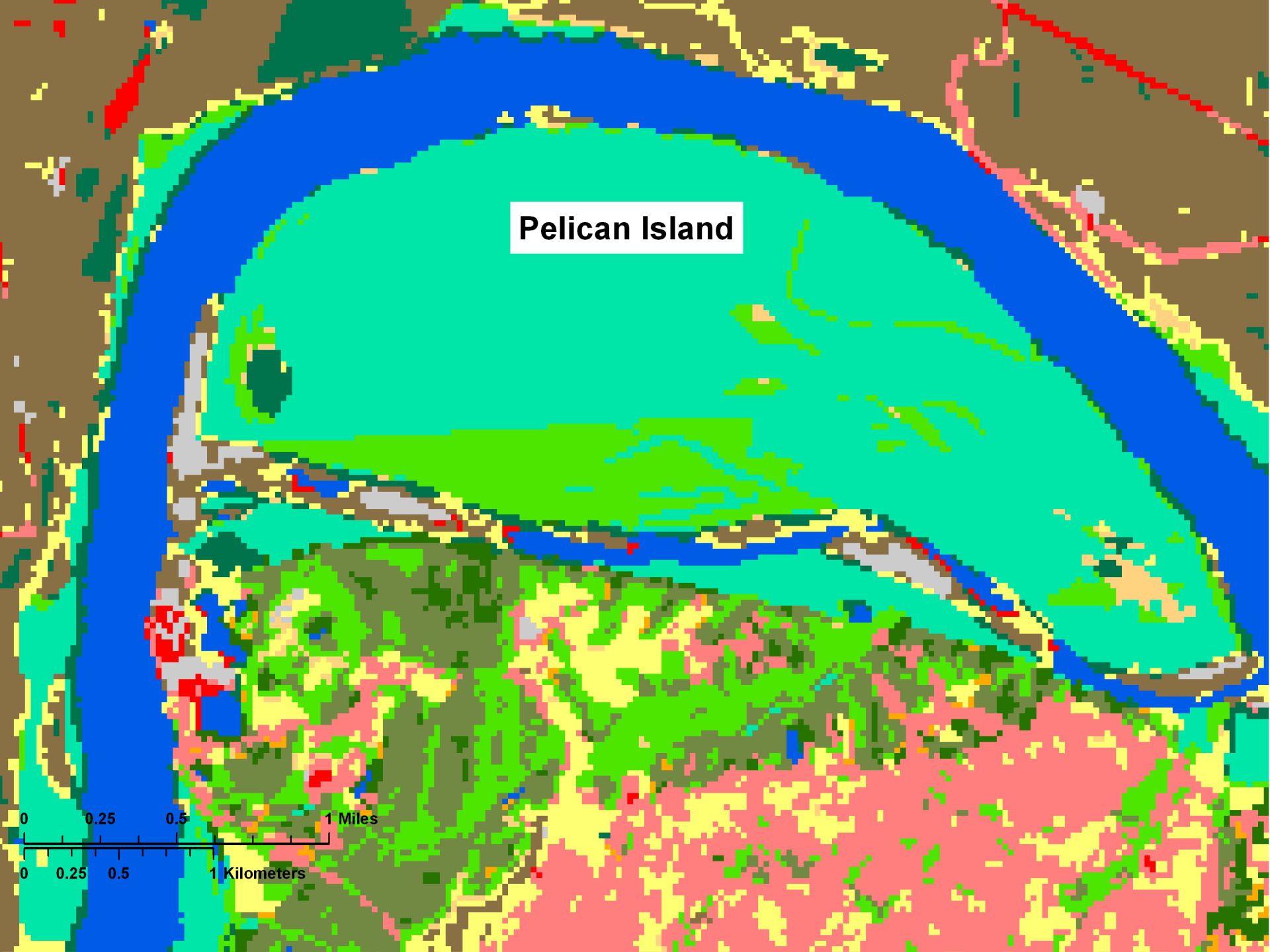
- 1 meter NAIP resampled to 6 meters
- Leaf-on and leaf-off merged
- eCognition Developer
- Scale factor of 15
- Smallest objects “Eliminated” in ArcInfo

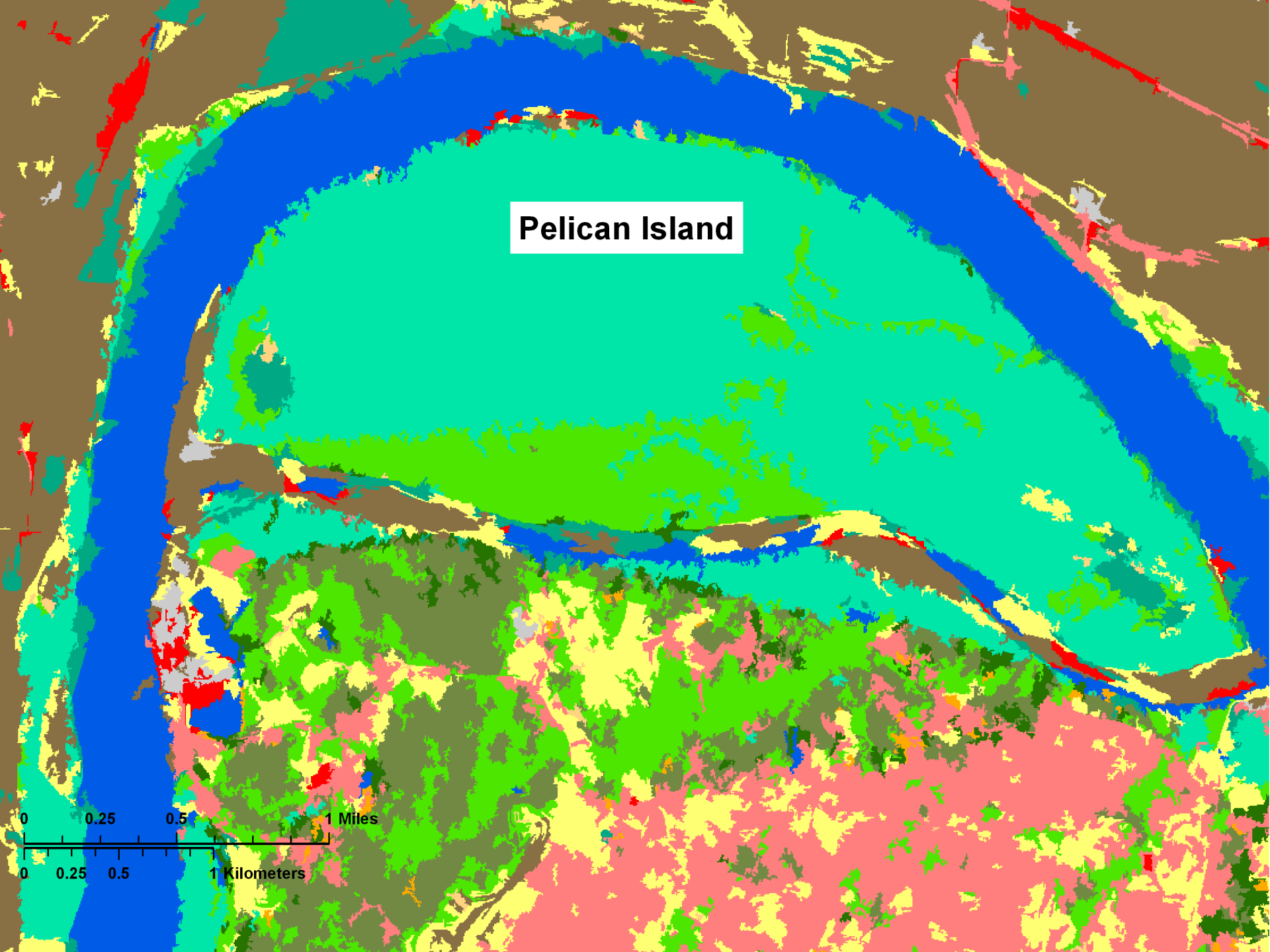
DEFINIENS
Understanding Images

ArcGIS
GIS by ESRI®

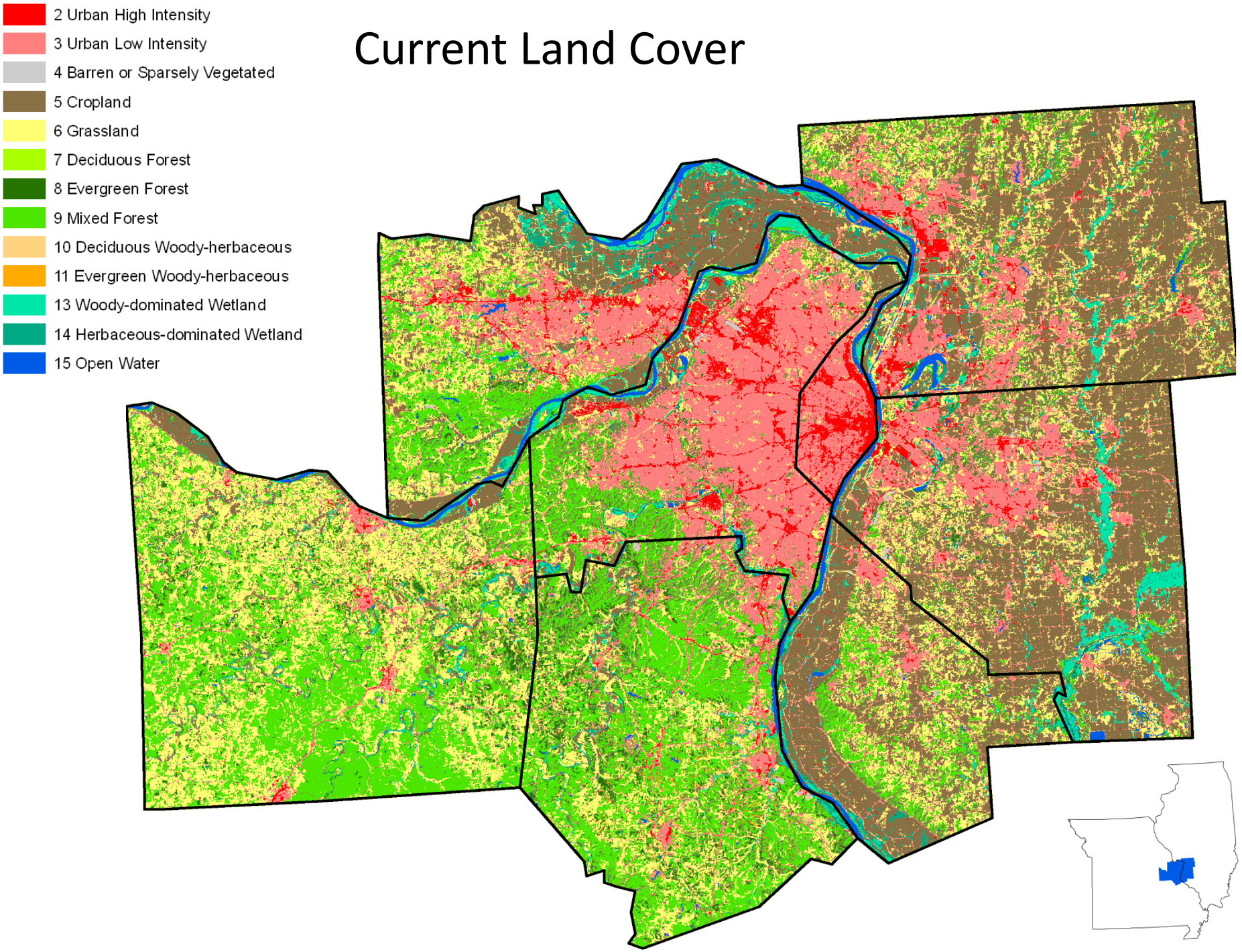
Pelican Island
0 0.25 0.5 1 Miles
0 0.25 0.5 1 Kilometers


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

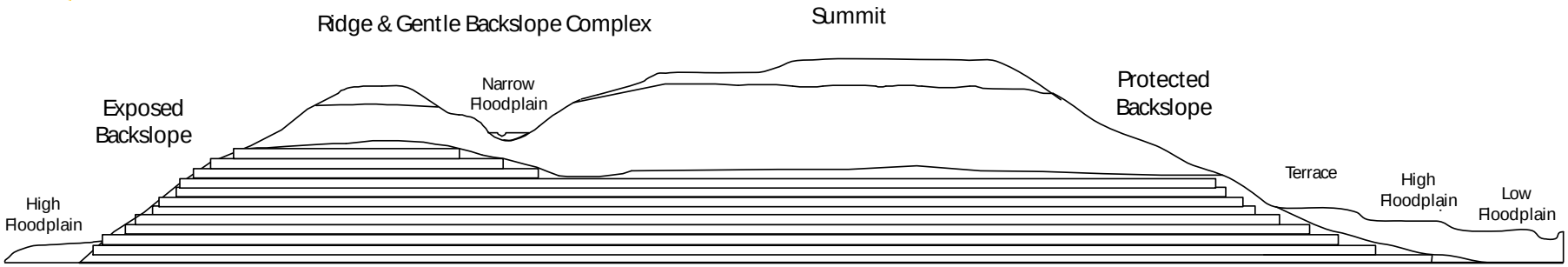
Current Land Cover



Missouri ELT Development Process

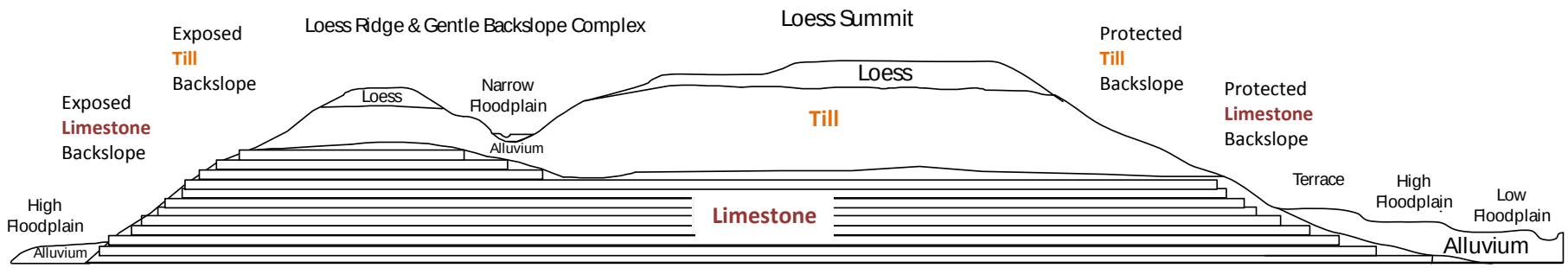
-

1) Landforms are identified within a given landscape.



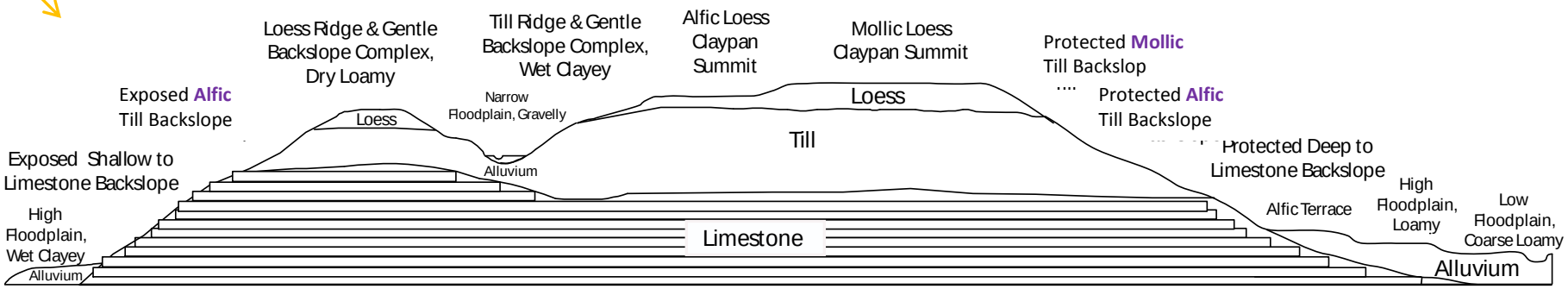
Missouri ELT Development Process

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



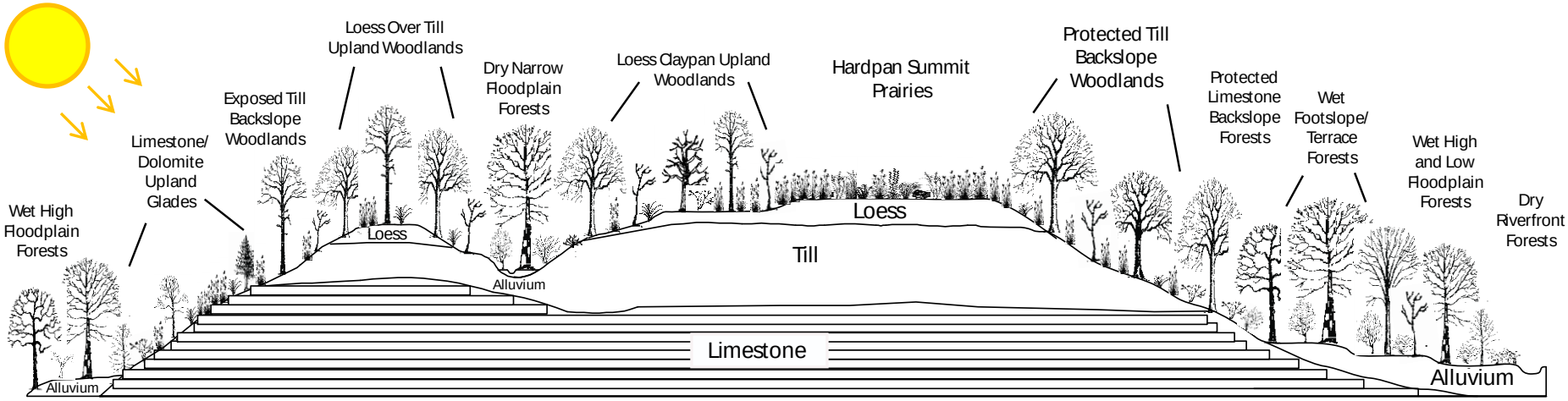
Missouri ELT Development Process

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

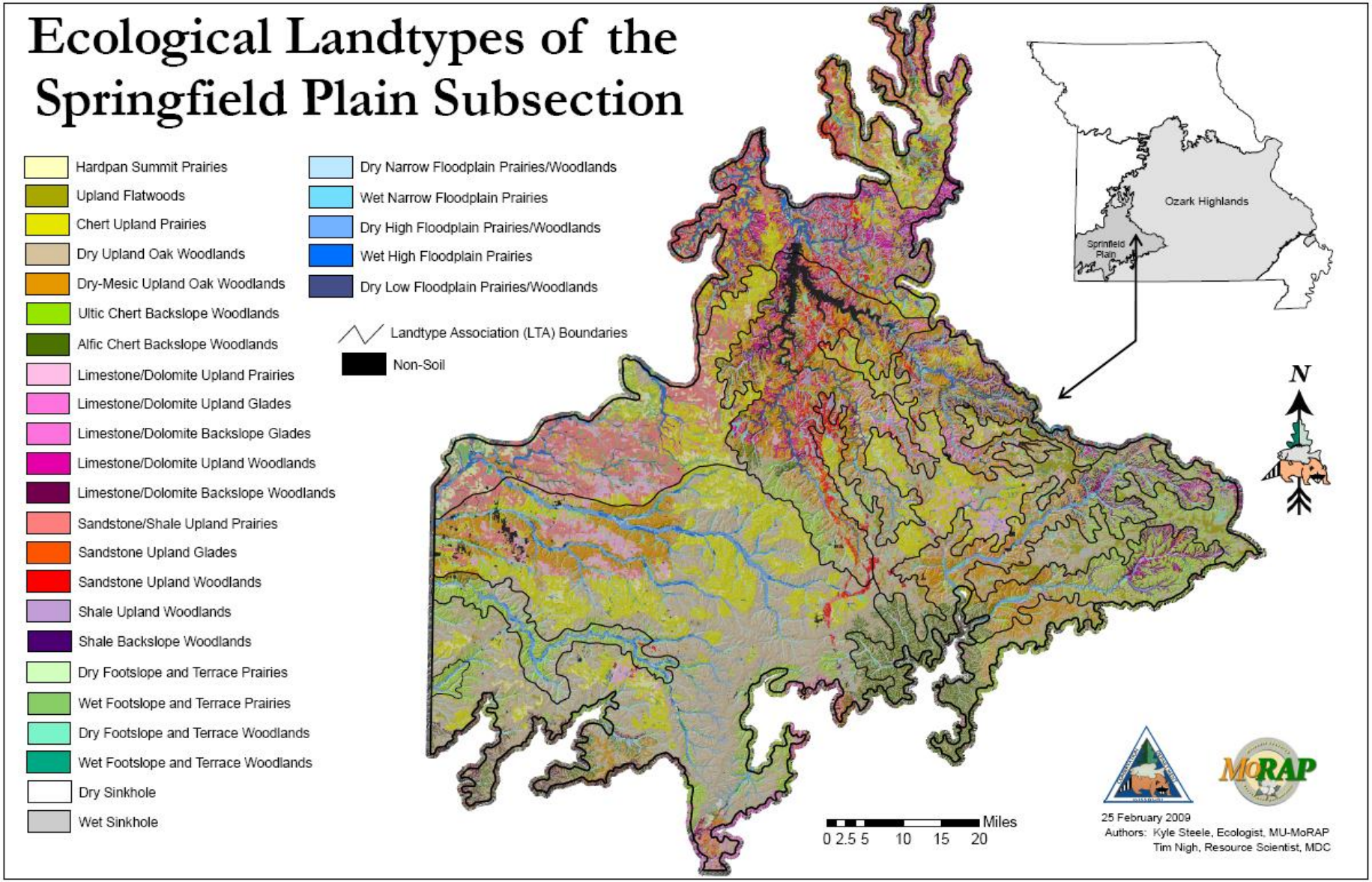


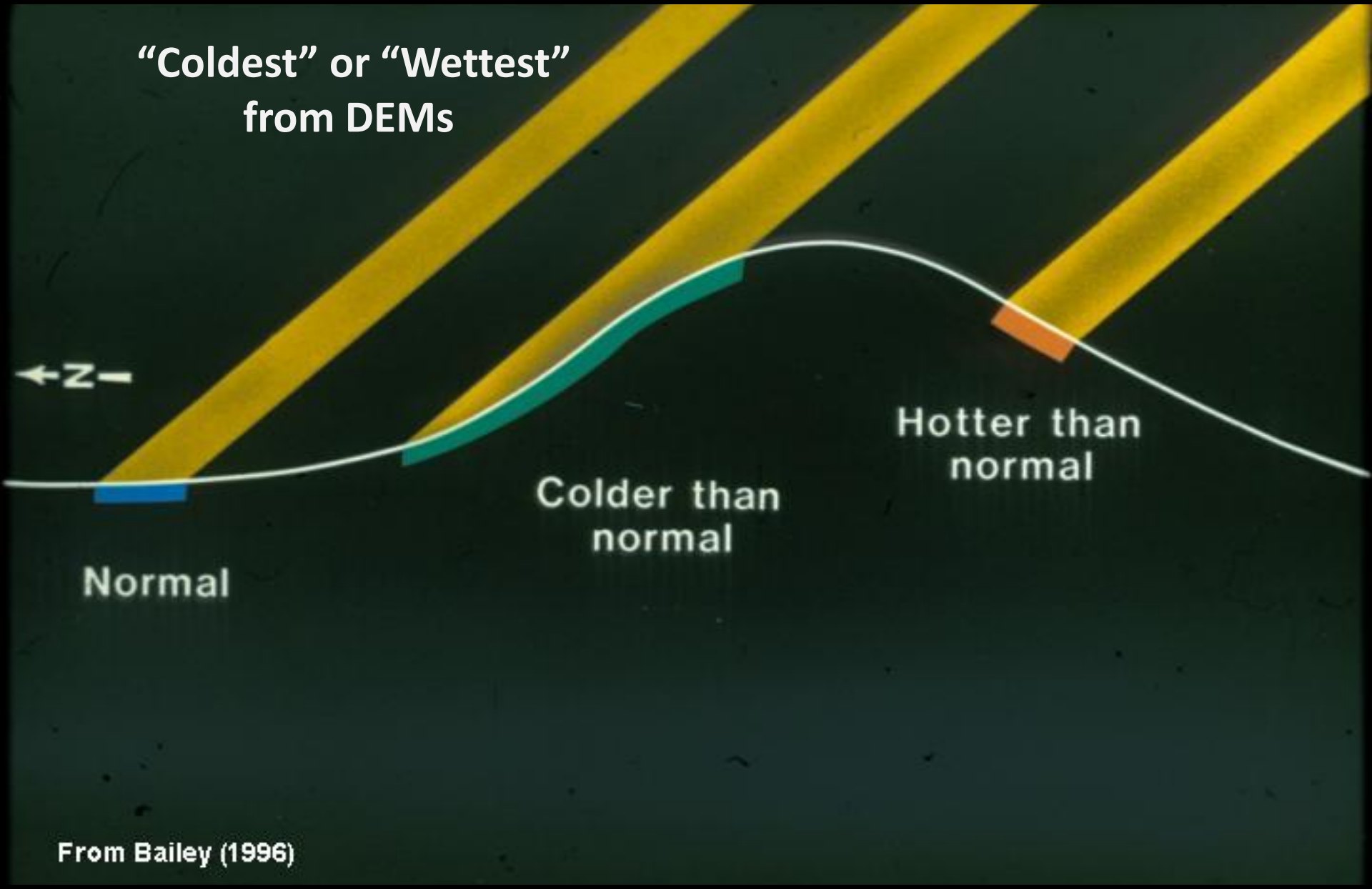
Missouri ELT Development Process

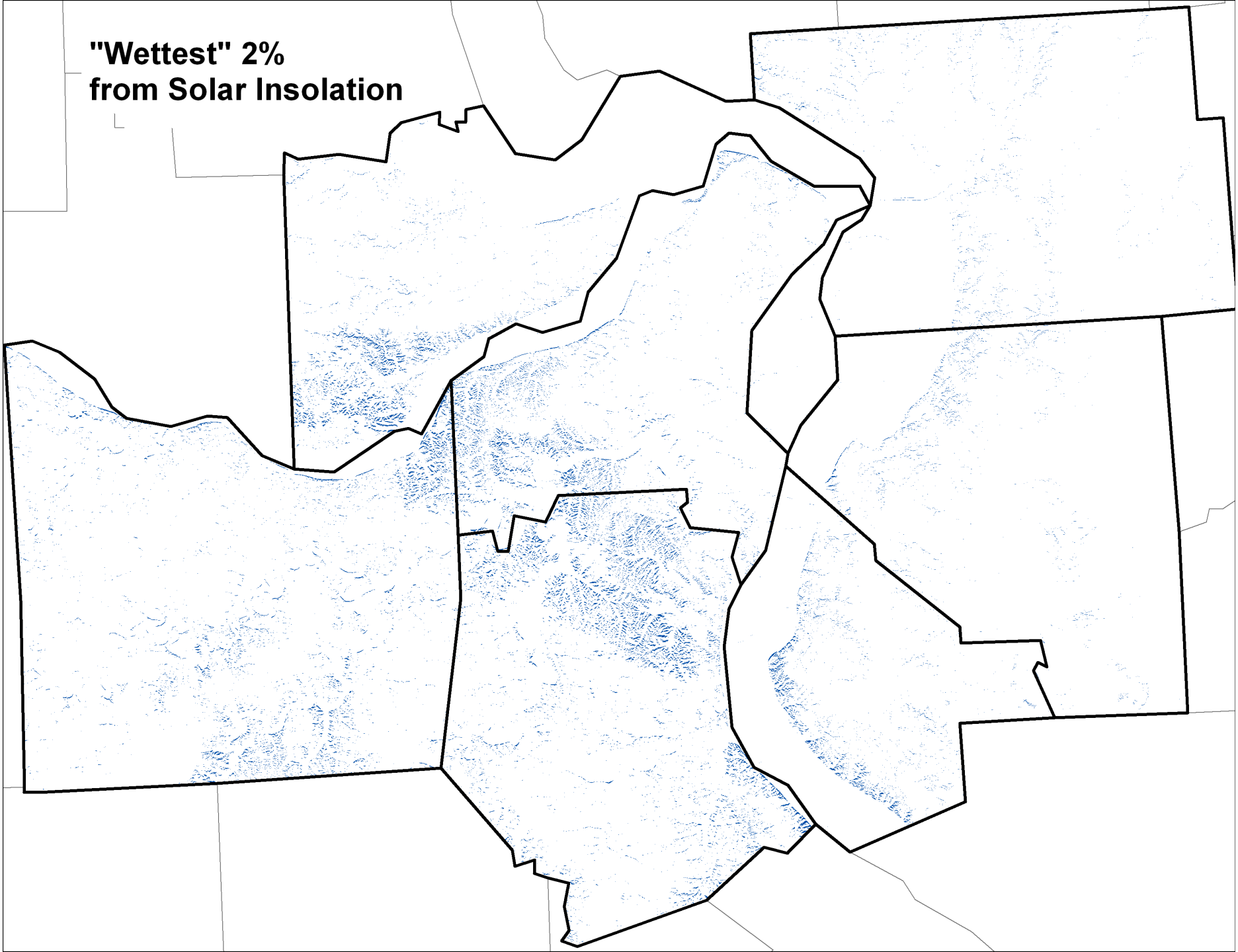
4) Potential **Natural Communities** are then tied to each land unit, resulting in **ELTs and ELT Phases**.



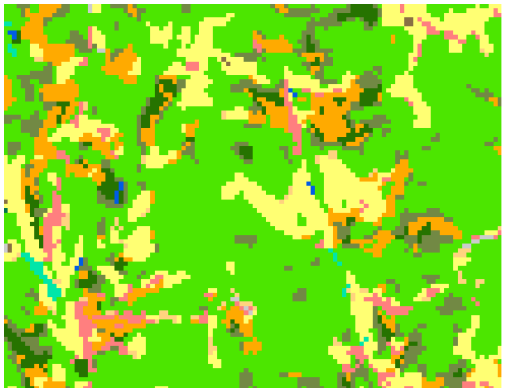
Example for the Springfield Plain



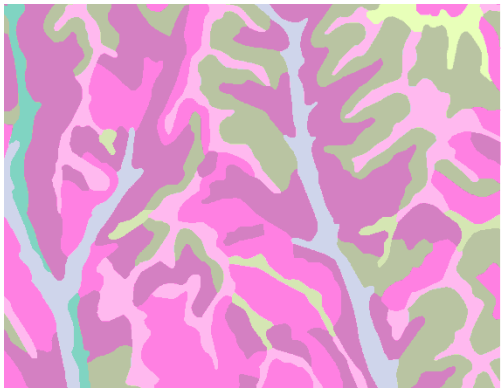

"Coldest" or "Wettest"
from DEMs
←Z—
Hotter than
normal
Colder than
normal
Normal
From Bailey (1996)


"Wettest" 2%
from Solar Insolation

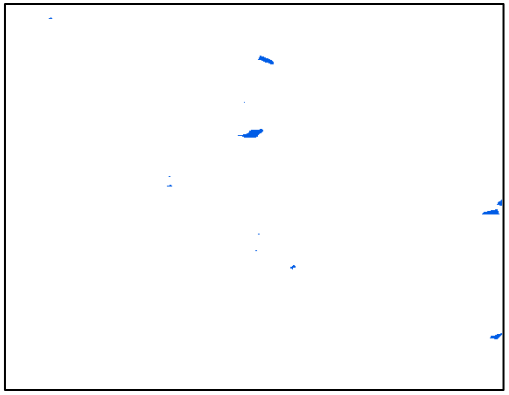
Land Cover and Ancillary Data Applied to Image Objects to Map 60 Current Vegetation Types



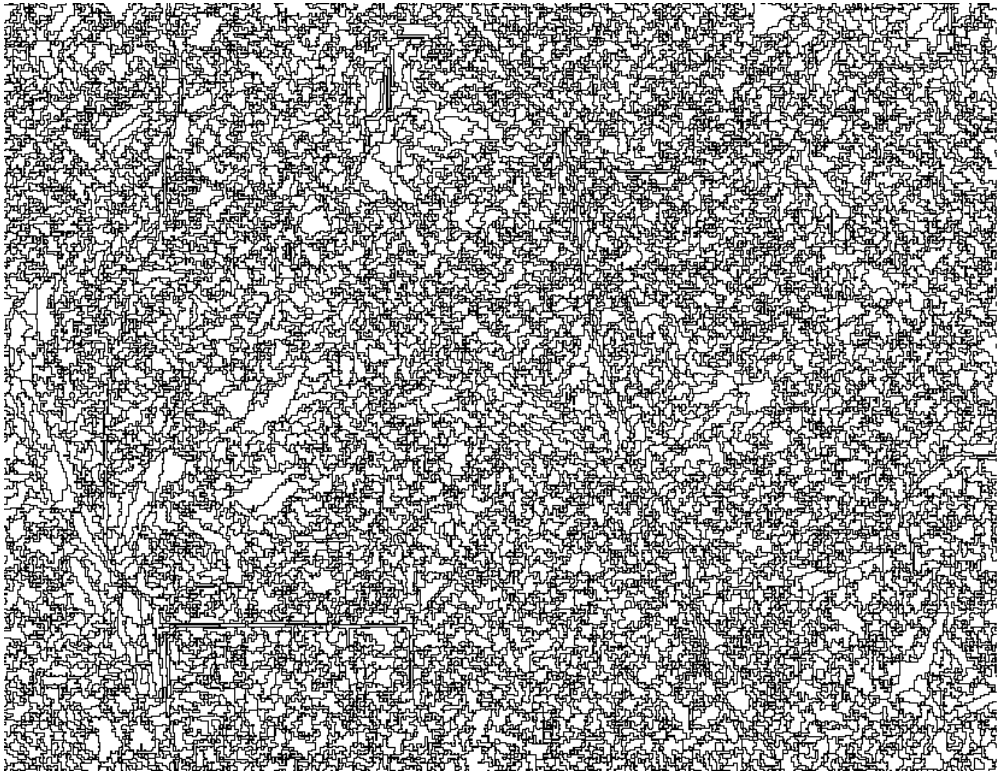
Land Cover



ELT's



"Wettest" Areas



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

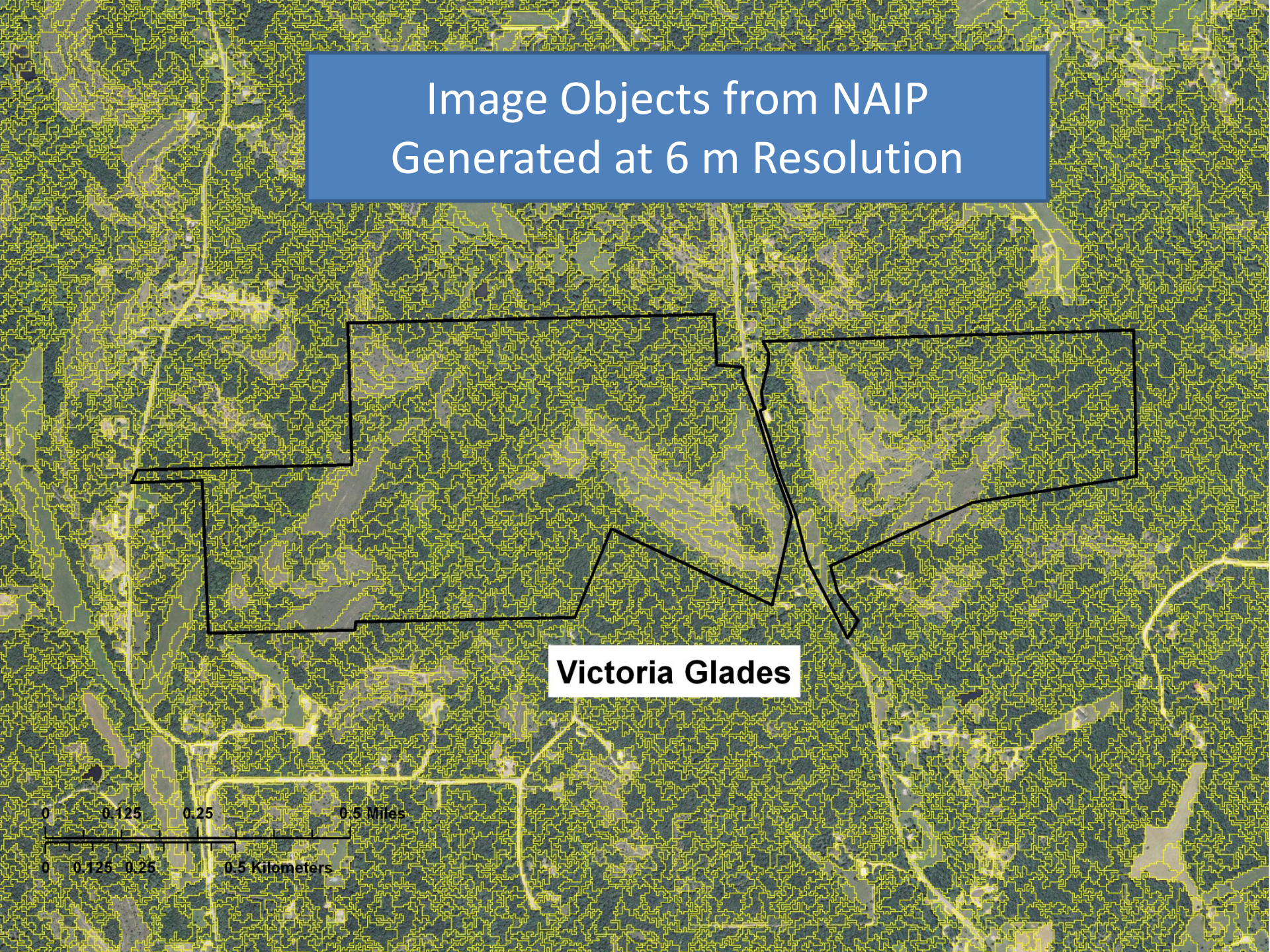
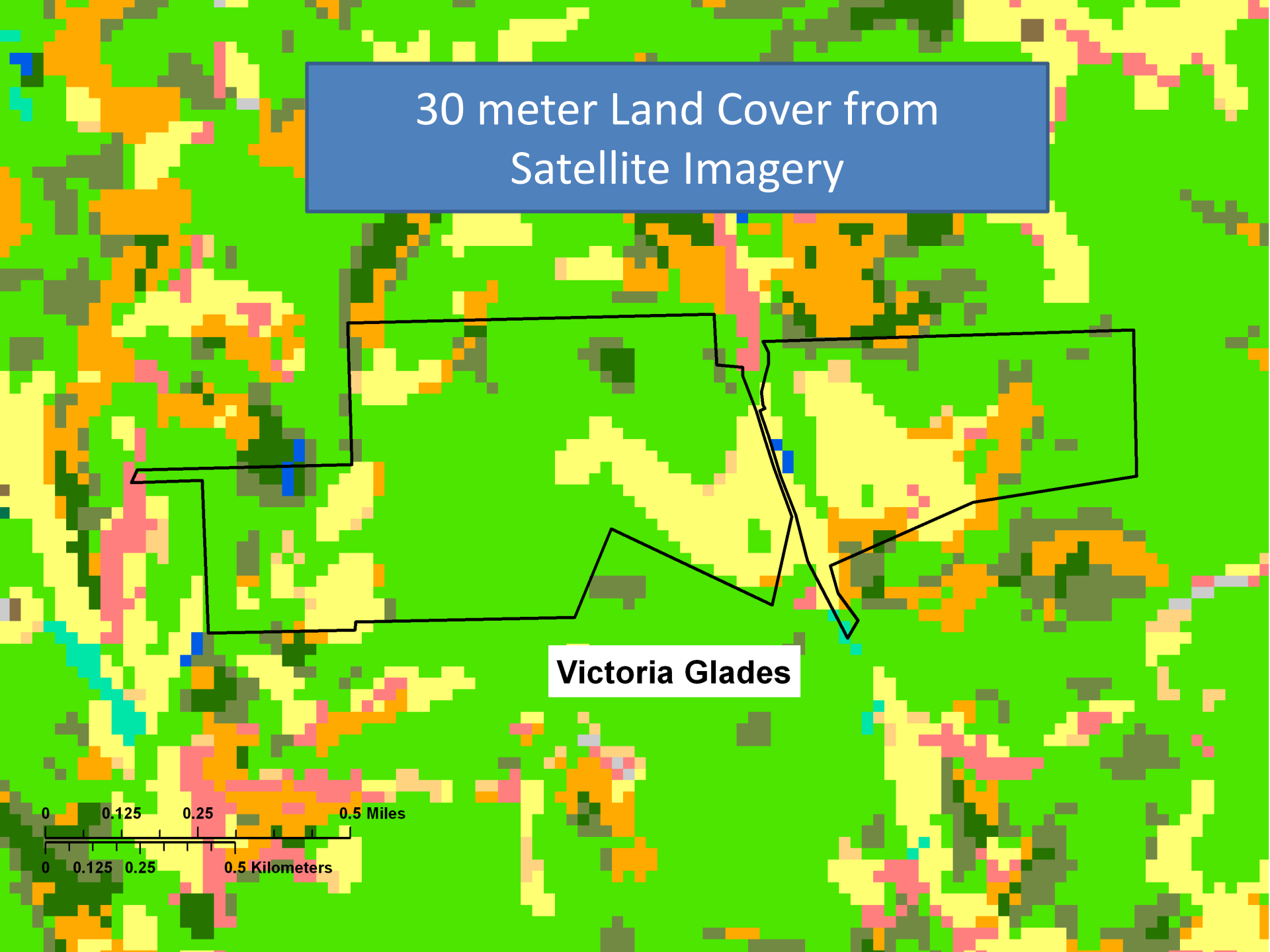
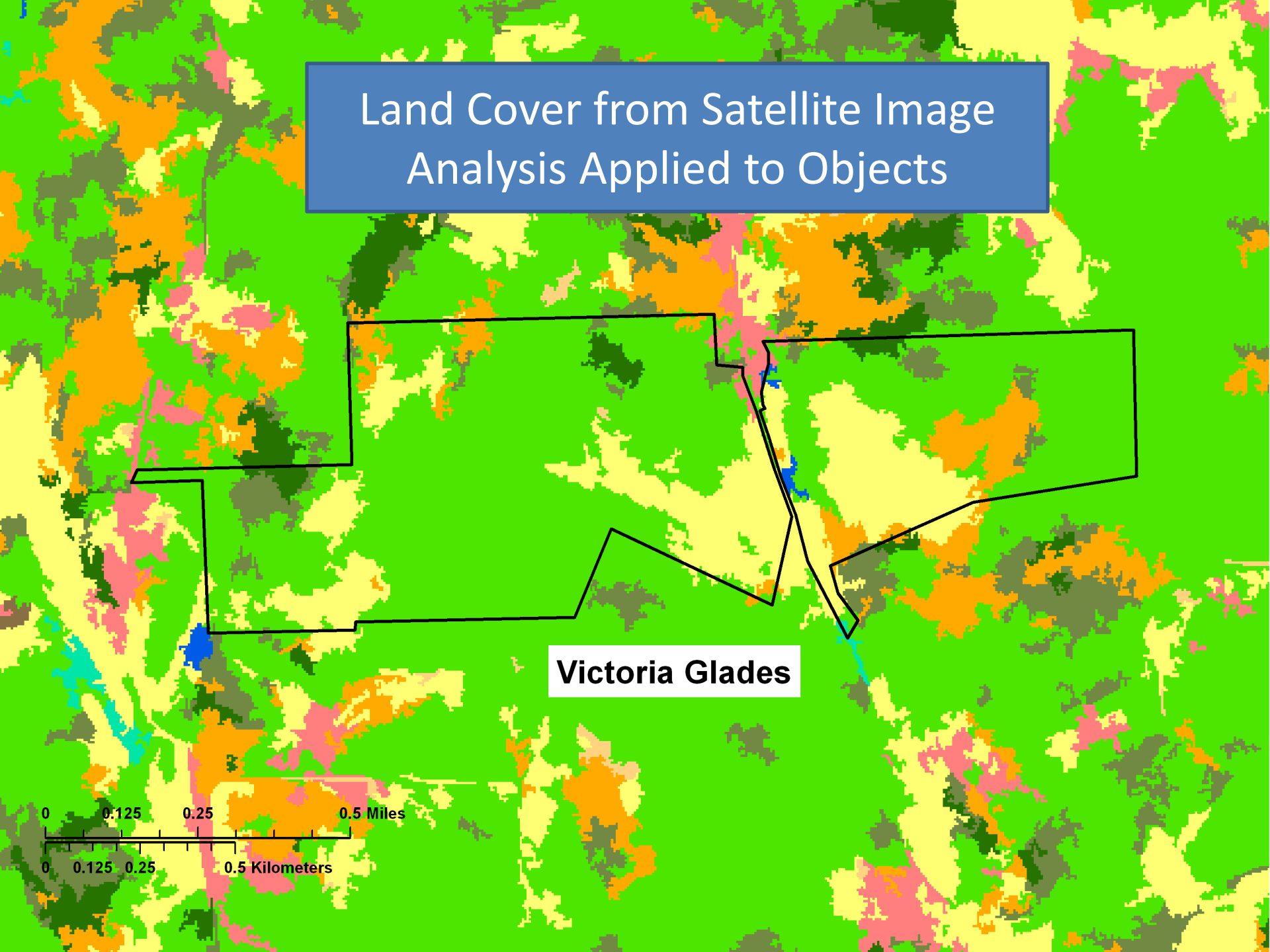


Image Objects from NAIP
Generated at 6 m Resolution
Victoria Glades
0
0.125
0.25
0.5 Miles
0
0.125
0.25
0.5 Kilometers


30 meter Land Cover from Satellite Imagery
Victoria Glades
0 0.125 0.25 0.5 Miles
0 0.125 0.25 0.5 Kilometers

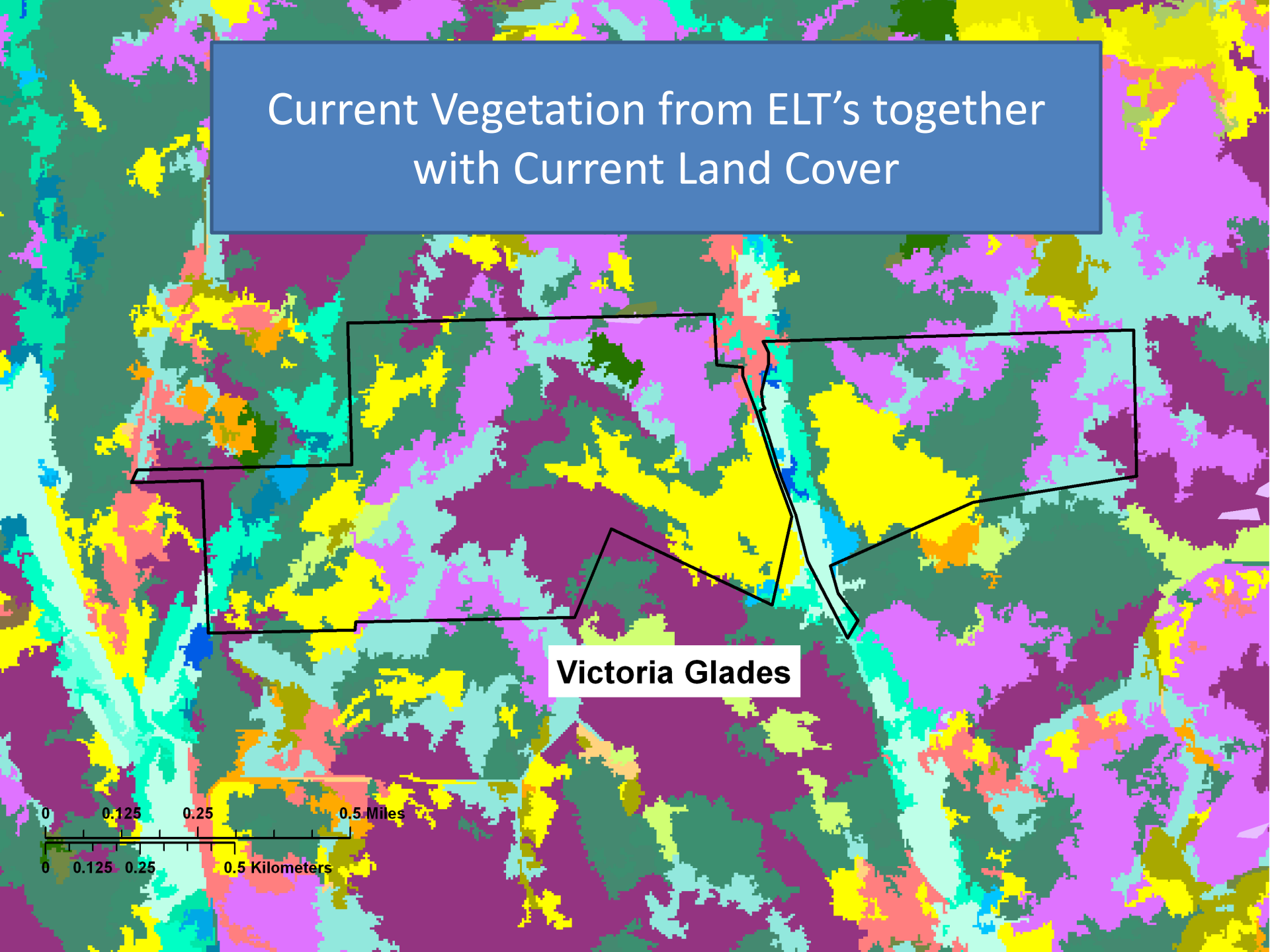
Land Cover from Satellite Image Analysis Applied to Objects



Current Vegetation Classes for Victoria Glades Area

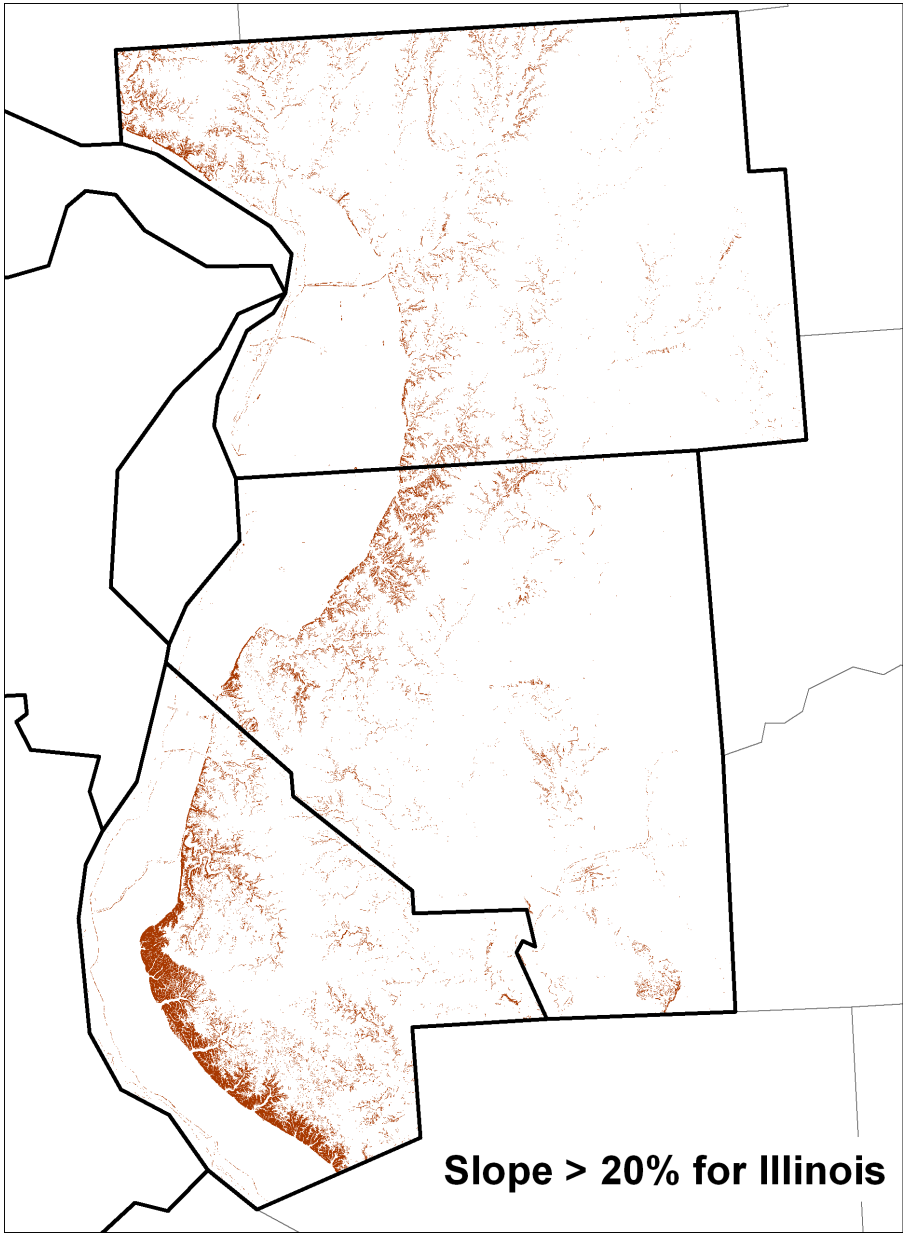
- 3 Urban Low Intensity
- 5 Cropland
- 6 Grassland
  - Bottomland: Herbaceous Vegetation
  - Cultural/Disturbance: Upland Limestone/Dolomite and Chert Grassland
  - Cultural/Disturbance: Upland Loess and Till Grassland
  - Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (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



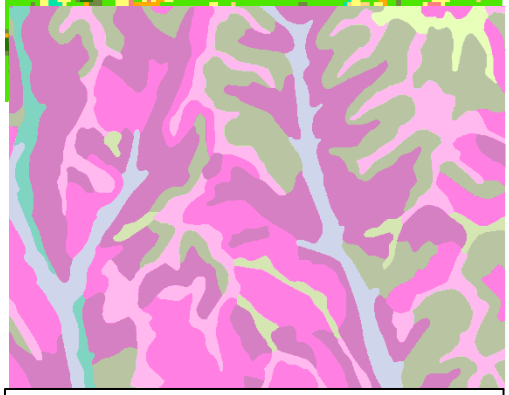
Illinois has no ELTs

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



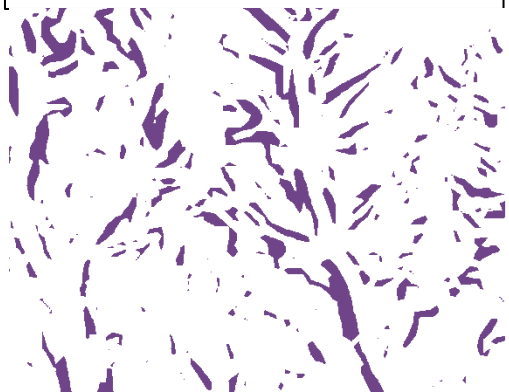
Land Cover and Ancillary Data is Applied to Objects in Illinois

Land Cover

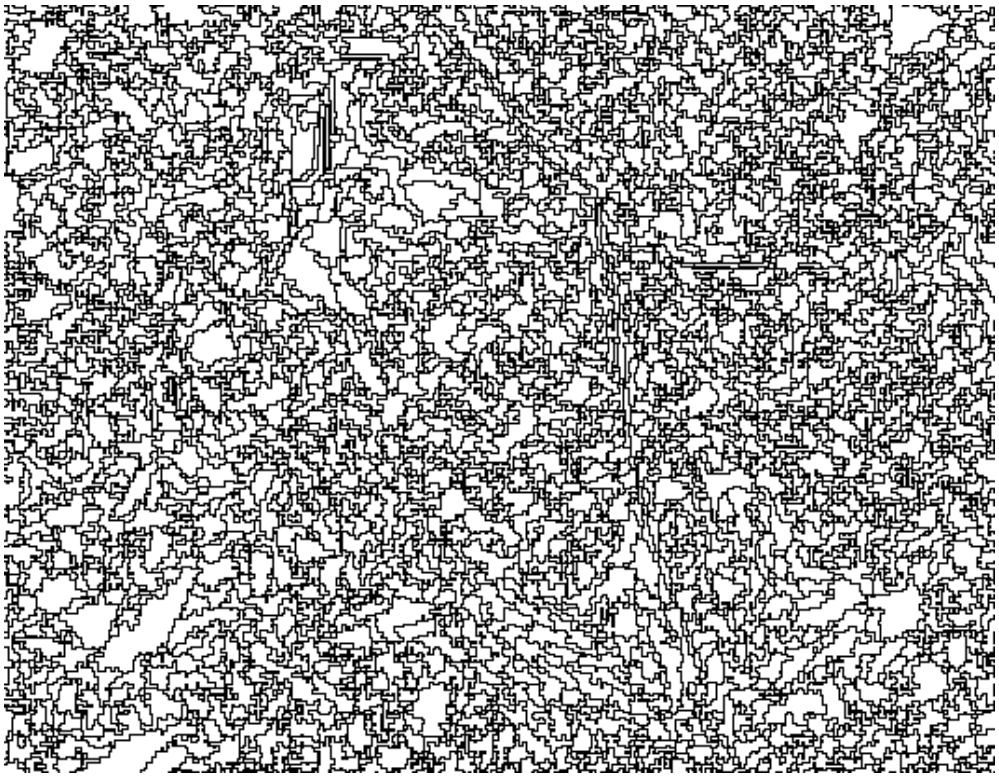


Soils

"Wettest" Areas

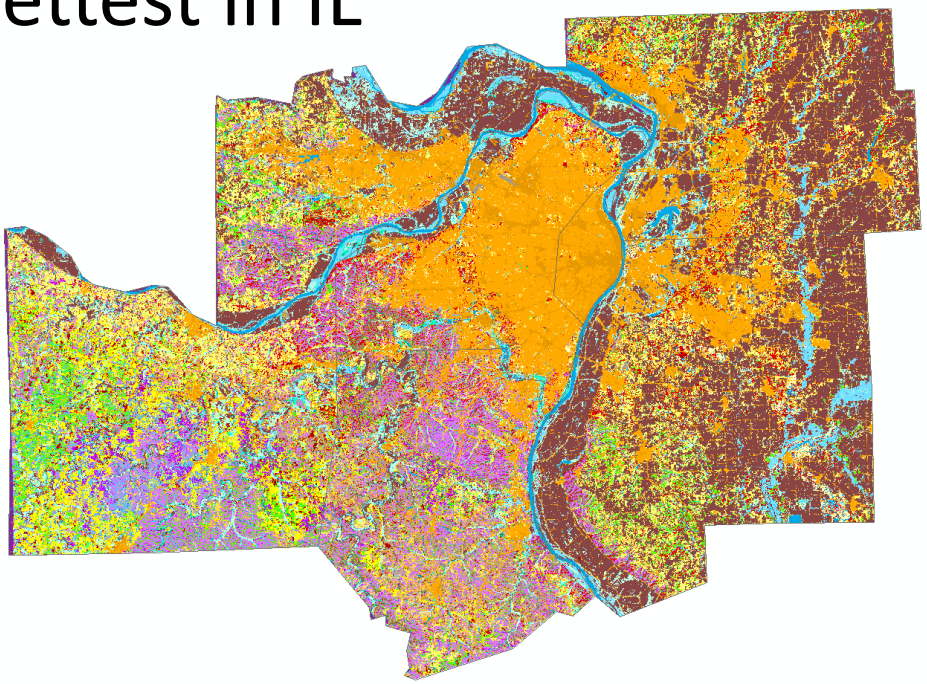


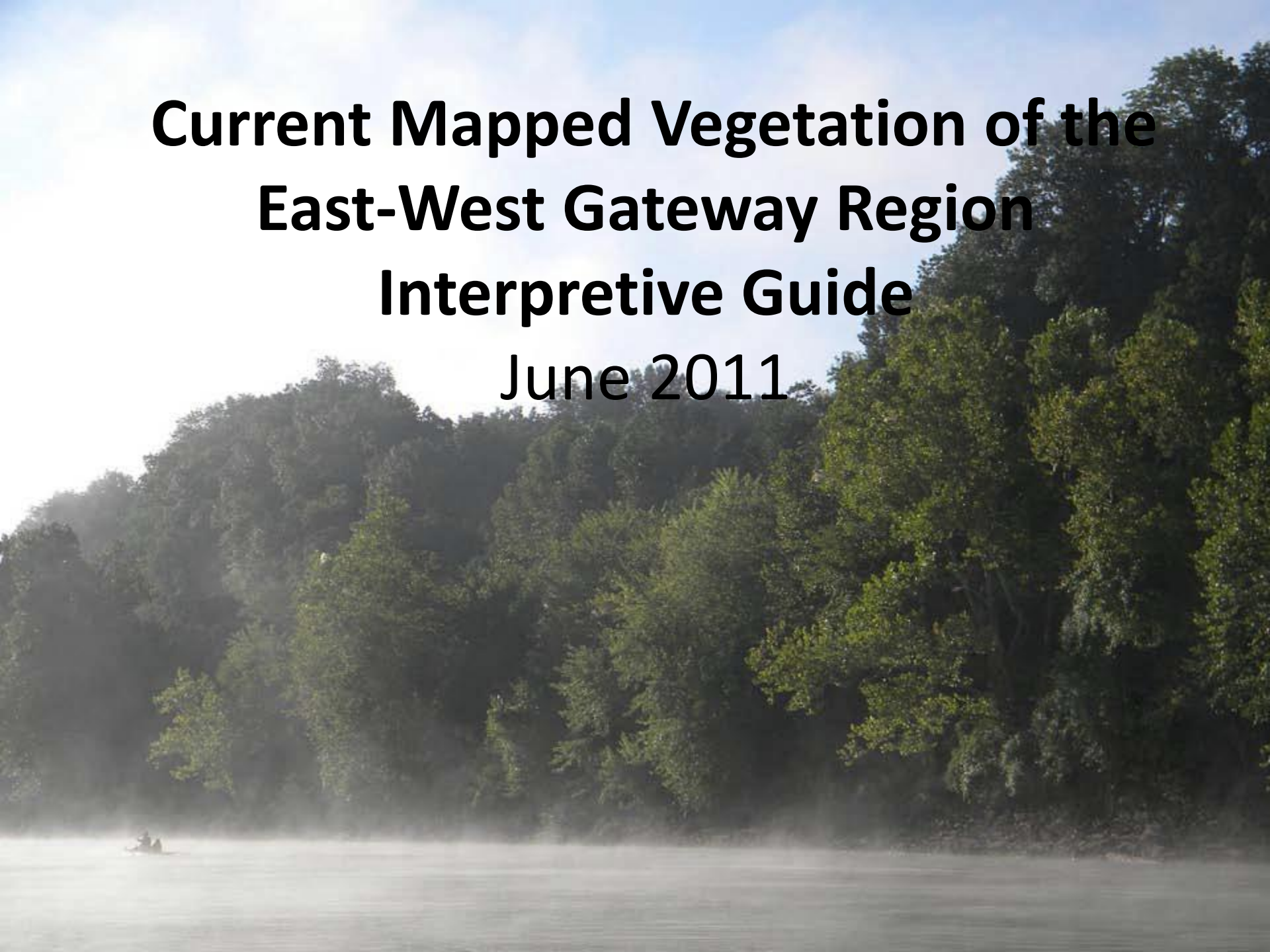
Steep Slopes



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
- 1.15 million polygons



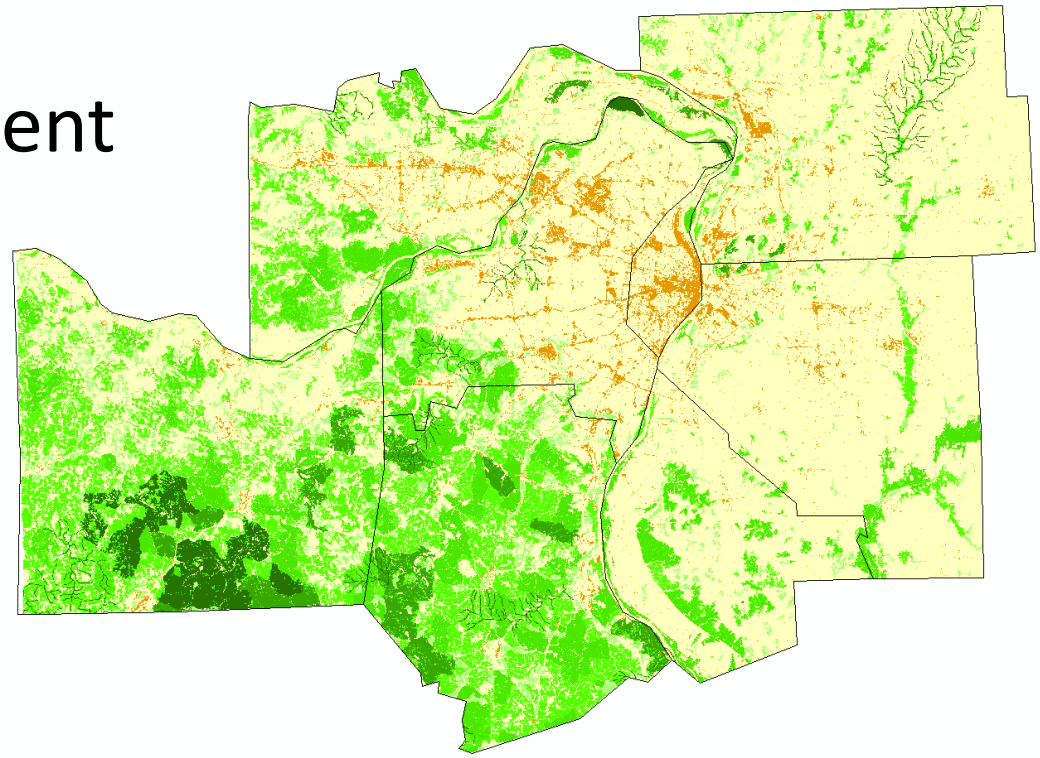


Current Mapped Vegetation of the East-West Gateway Region Interpretive Guide

June 2011

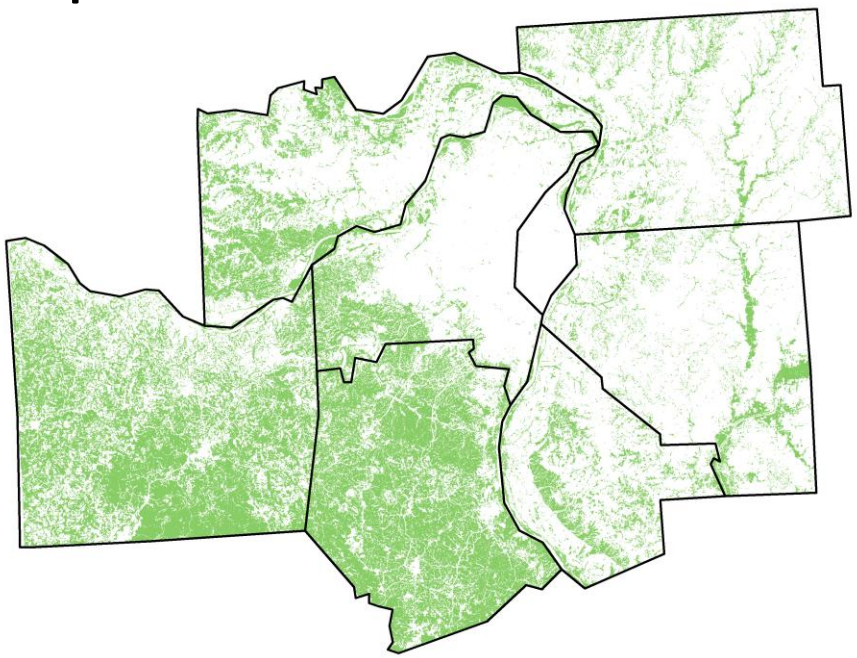
2. Regional Ecological Significance Modeling

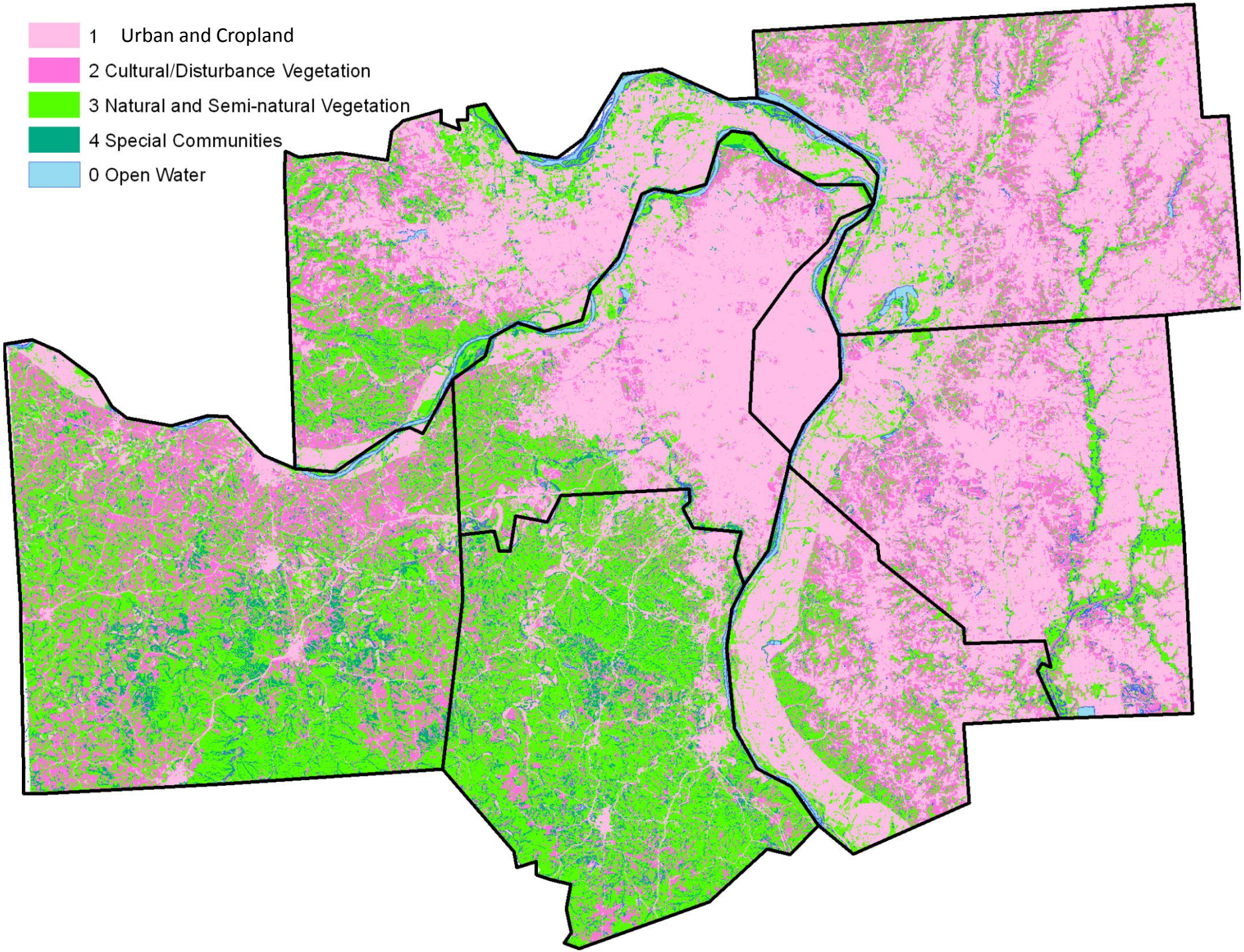
- Development of Patches
- Attribution of Patches
- Aquatic Inputs
- Model Development

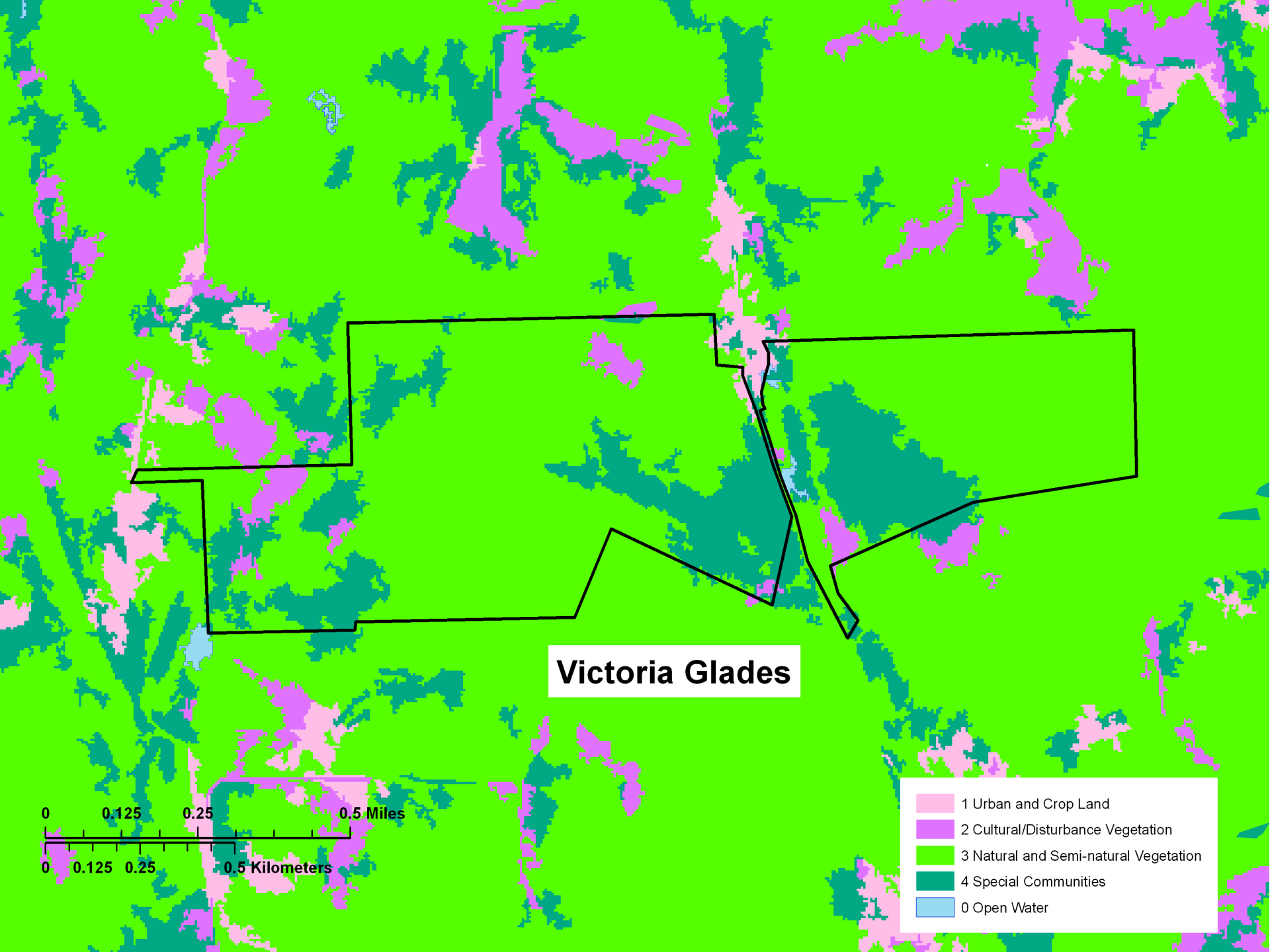


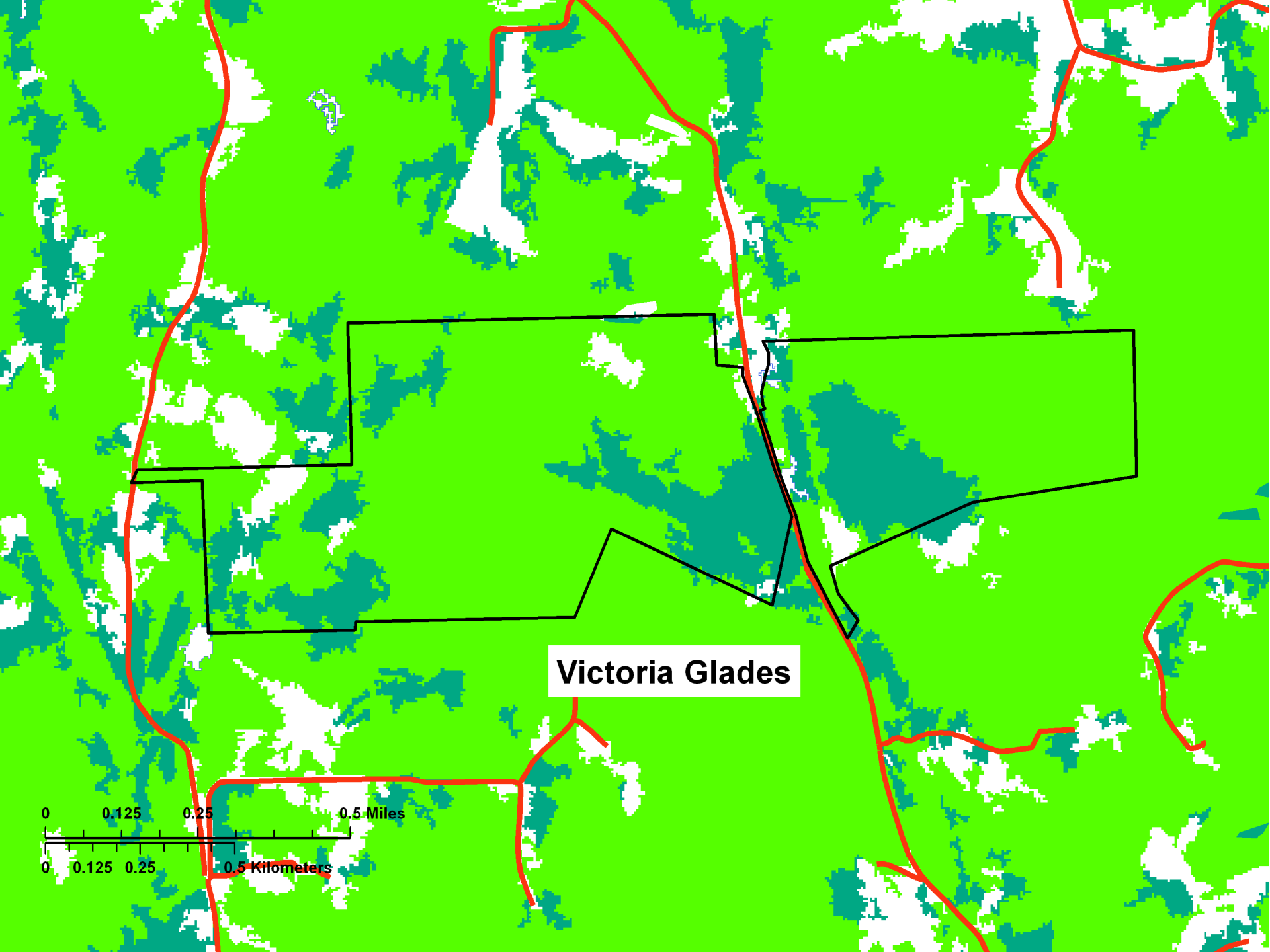
Development of Patches

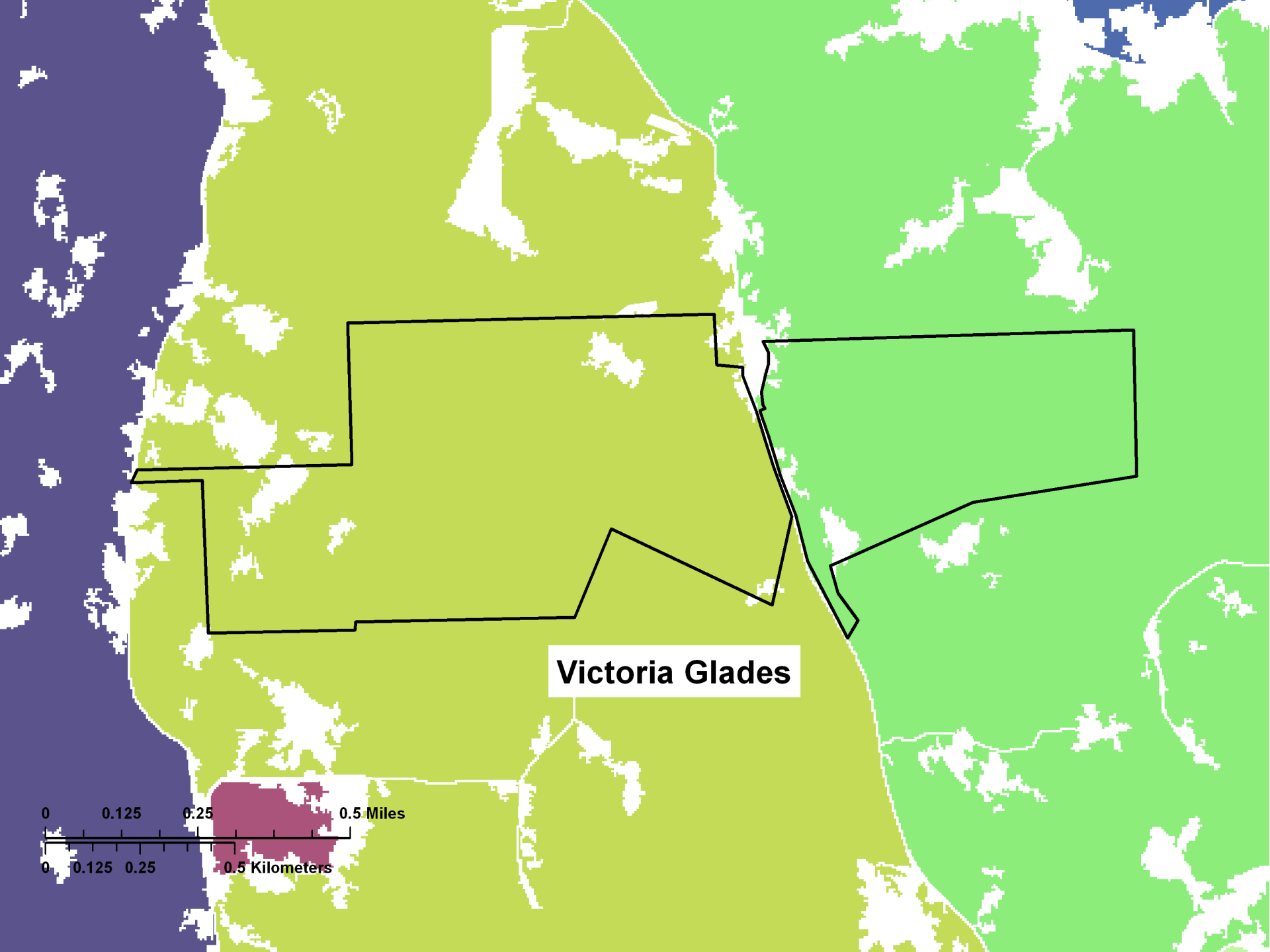
- Categorize current vegetation
- Aggregate Condition 3 & 4
- Clip polygons with roads
- Cut largest polygon into 3 patches
- 23,578 total patches




1 Urban and Cropland
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
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

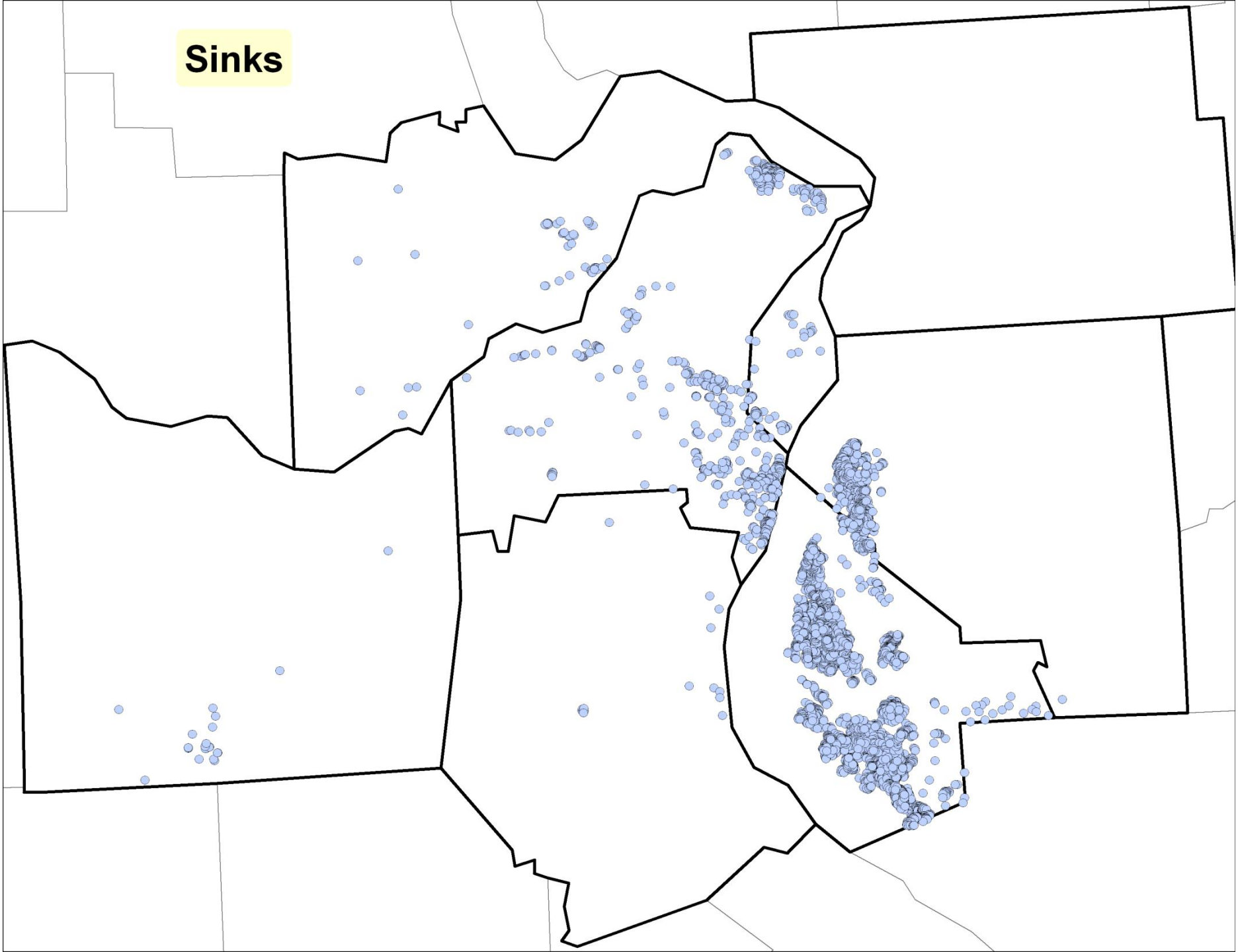
Ecological Significance Ranking: Conceptual Underpinning

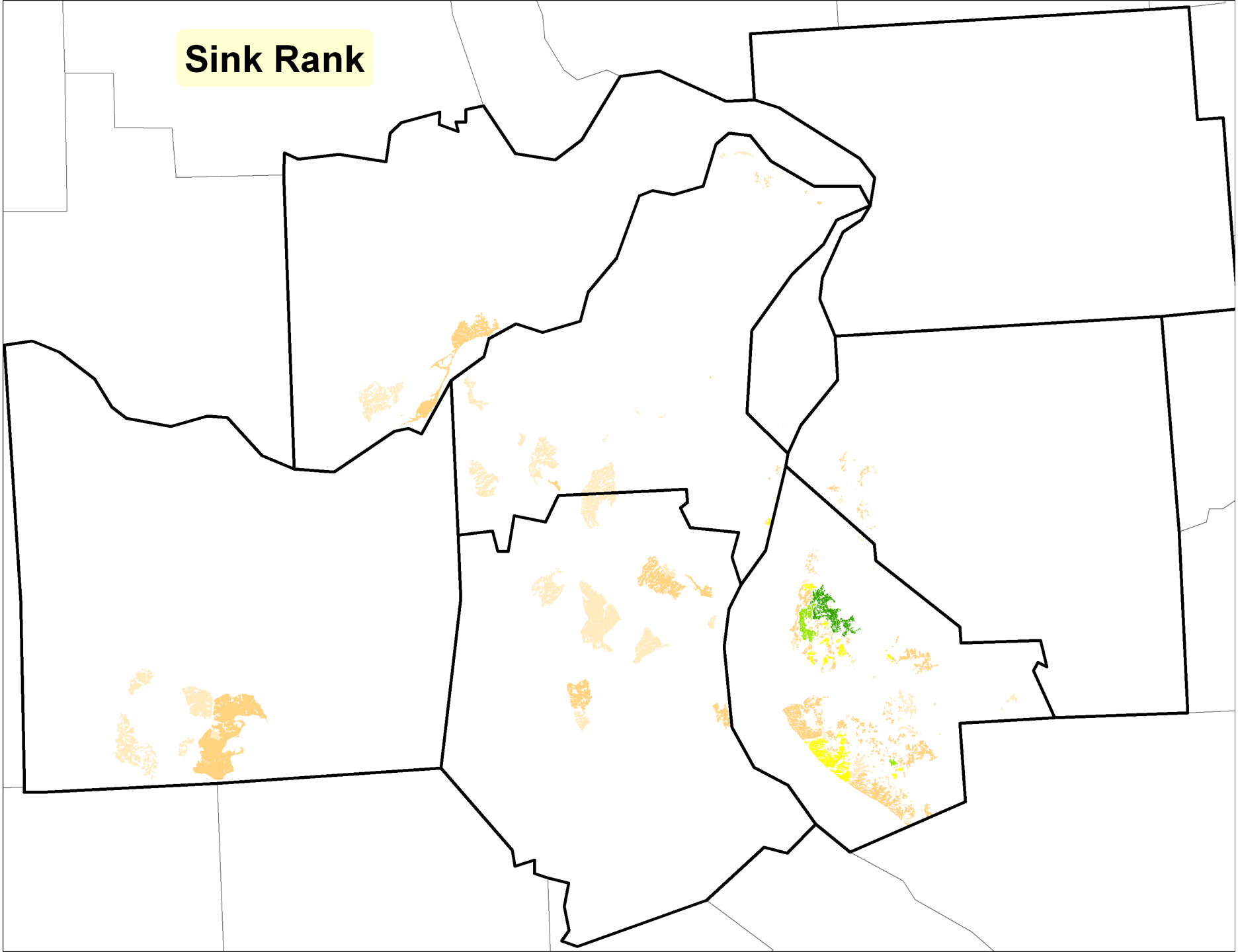
- Coarse filter / fine filter
  - Coarse filter conservation targets are communities
  - Fine filter targets are species
- Consider long-term functionality
  - Most species of conservation concern require fairly large patches to maintain viable populations
  - Existing public lands offer the opportunity to create larger preserves

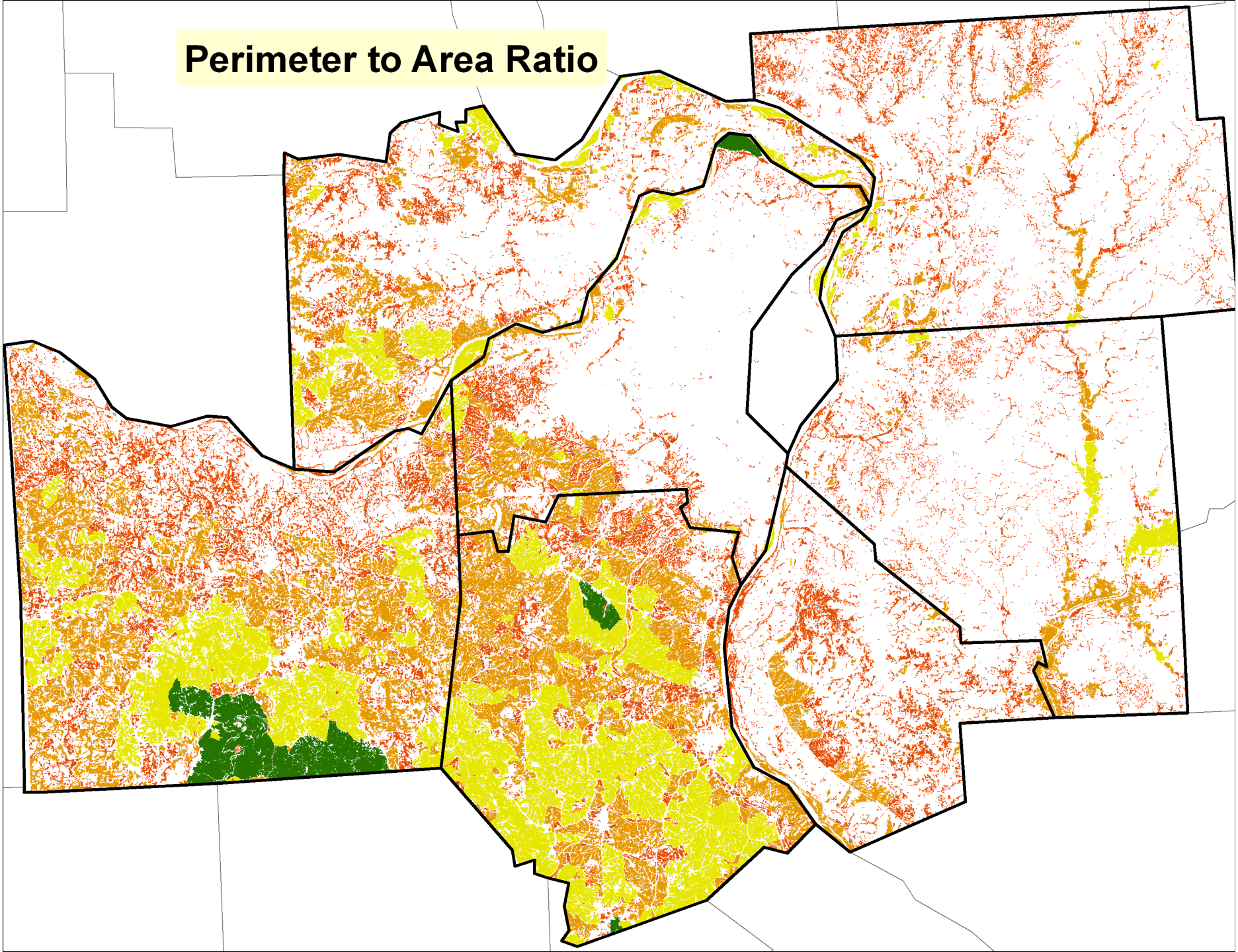
Attribution of Patches

- Size and Shape
- Area of Large Forest Patches
- Area of Significant Communities
- Area of Significant Stream Buffers
- Mapped Globally Rare Species
- Mapped Regionally Significant Species
- Maximum Species Diversity from Models
- Number of Springs
- Number of Karst Sinks
- Area of Public Land

All ranked 1-5

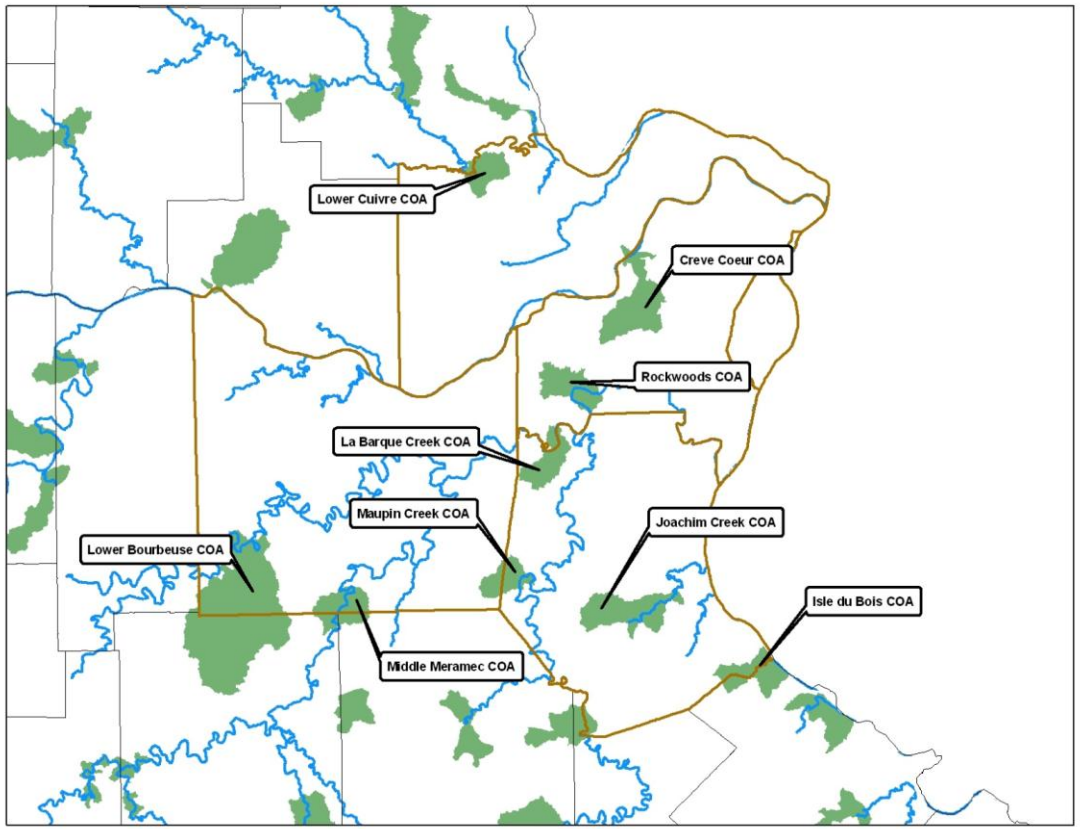

Sinks


Sink Rank

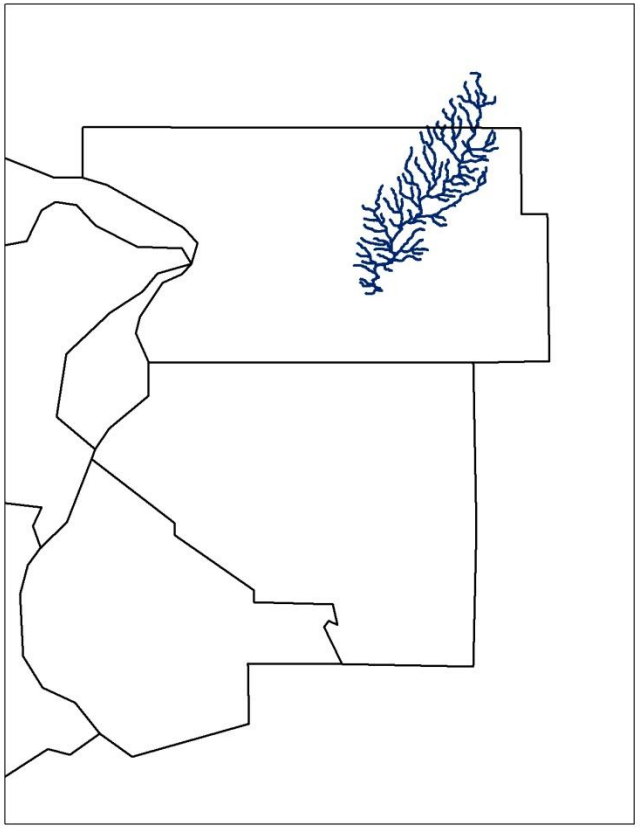

Perimeter to Area Ratio

50 Meter Stream Buffer on 100K NHD

Aquatic Conservation Opportunity Areas (COA)



Illinois Biologically Significant Streams



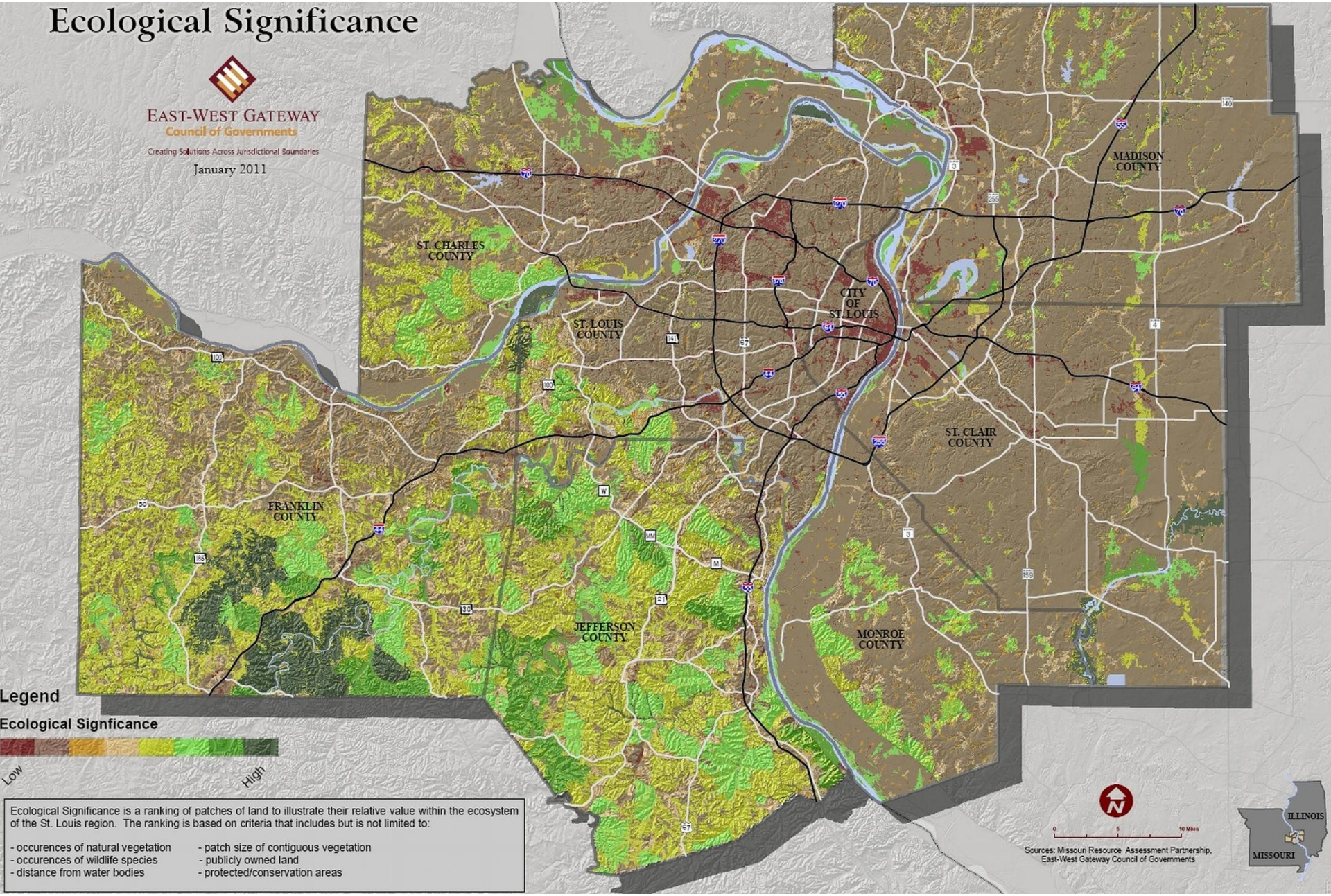
Patches Ranked into Tiers

- **Tier 1**, 2.5% of region: largest patches and previously identified aquatic priorities
- **Tier 2**, 2.3%: very large patches and globally rare species
- **Tier 3**, 7.6%: large patches plus a variety of other variables; including area of public lands
- **Tier 4**, 14.9%: functional patches >100 ha
- **Tier 5**, 4.1%: marginal functionality or near larger patches
- **Tier 6**, 2.5%: small natural patches
- **Tier 7**, 62.7%: cropland, urban low, very small patches
- **Tier 8**, 3.4%: urban high intensity land cover

Ecological Significance

EAST-WEST GATEWAY
Council of Governments
Creating Solutions Across Jurisdictional Boundaries

January 2011



Ecological Significance is a ranking of patches of land to illustrate their relative value within the ecosystem of the St. Louis region. The ranking is based on criteria that includes but is not limited to:

- occurences of natural vegetation
- occurences of wildlife species
- distance from water bodies
- patch size of contiguous vegetation
- publicly owned land
- protected/conservation areas

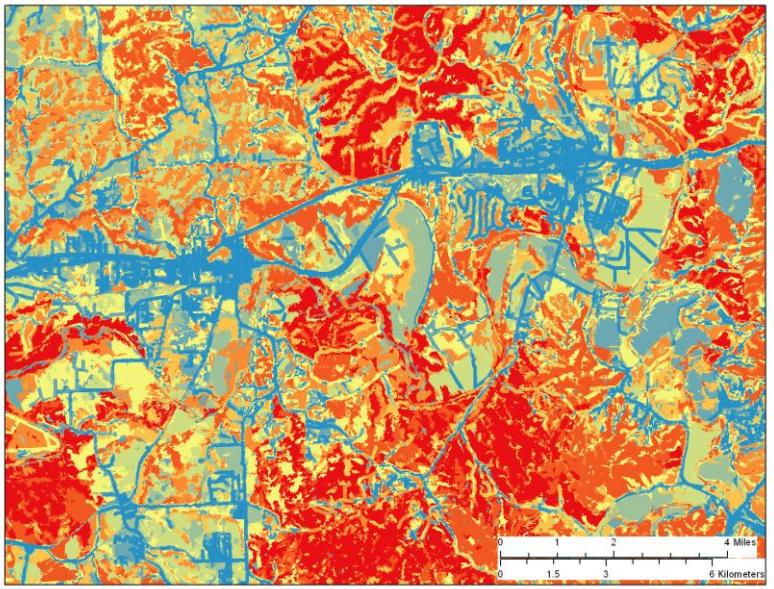
Ecological Approach to Infrastructure Development For the East-West Gateway Final Report for FY2011

3. Project-level Ecological Significance Modeling

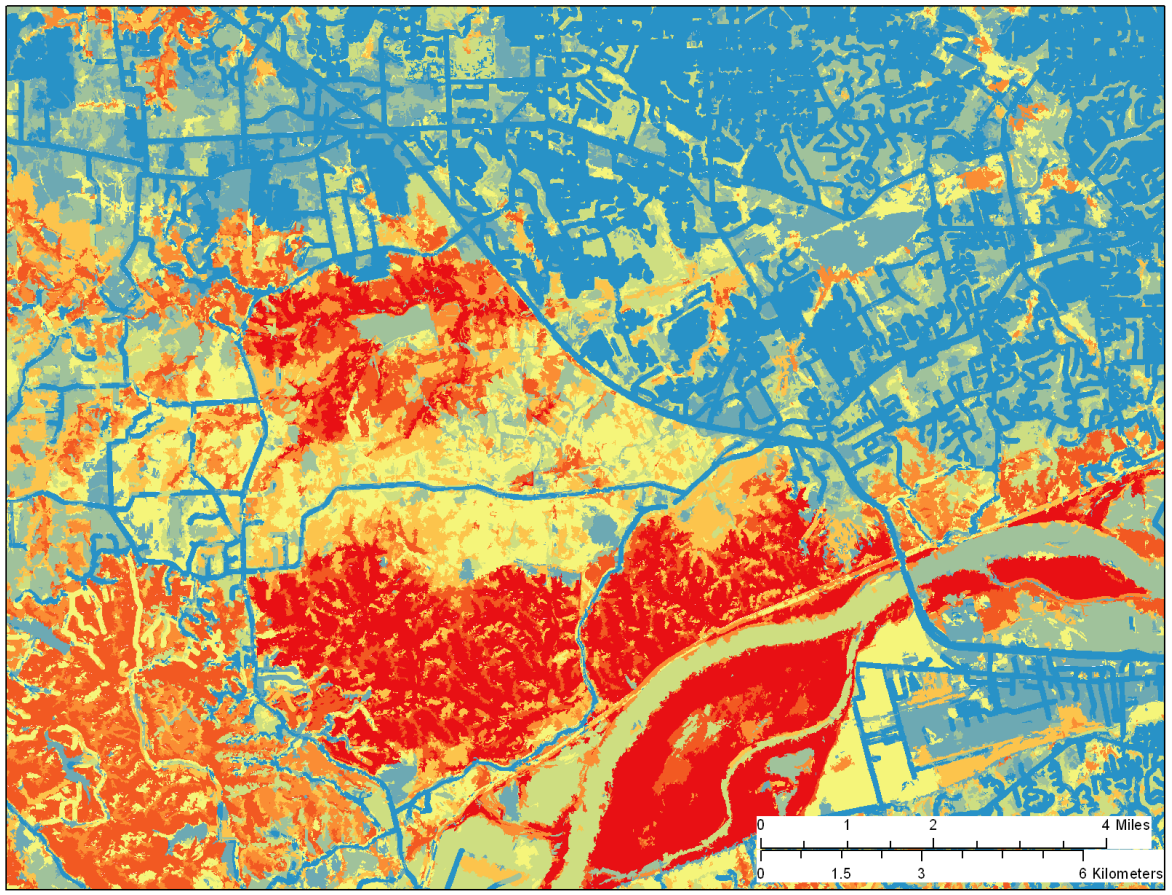
- Many of the same input datalayers generated for regional ecological significance used to generate project-level significance
- Regional significance based on patches of natural and semi-natural vegetation (many individual vegetation types combined)
- Scores applied to all current vegetation polygons to define project-level significance

Project-level Ecological Significance Ranking

- Community Importance
- Regional Significance
- Federal Rare Species
- Element Occurrence Record
- Public Lands
- Roads

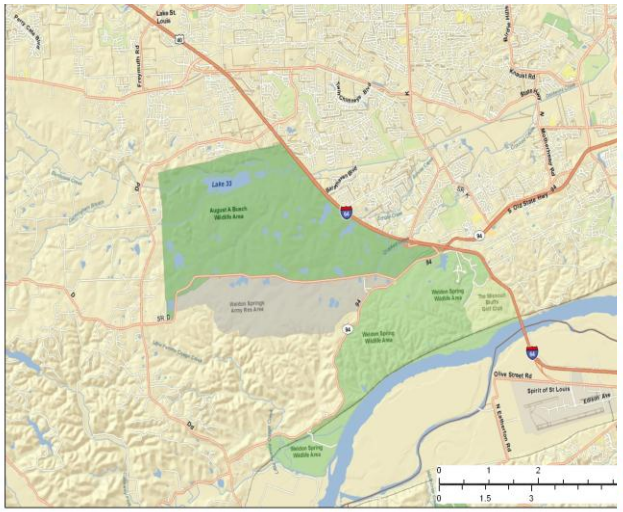


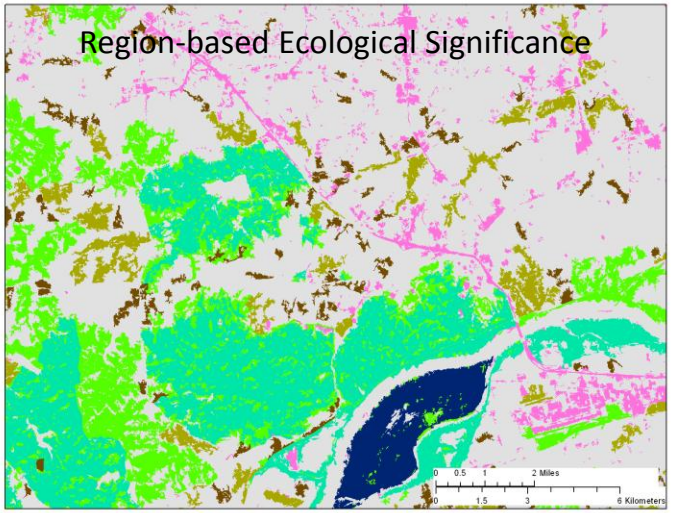
LaBarque Creek Conservation Area

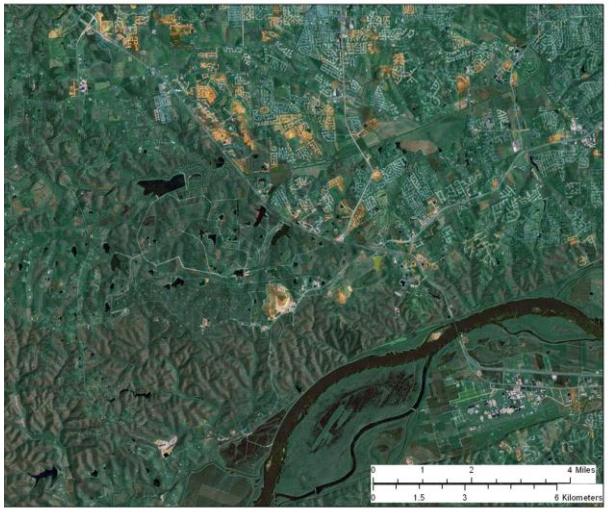


Project-based Ecological Significance

August A. Busch Wildlife Area

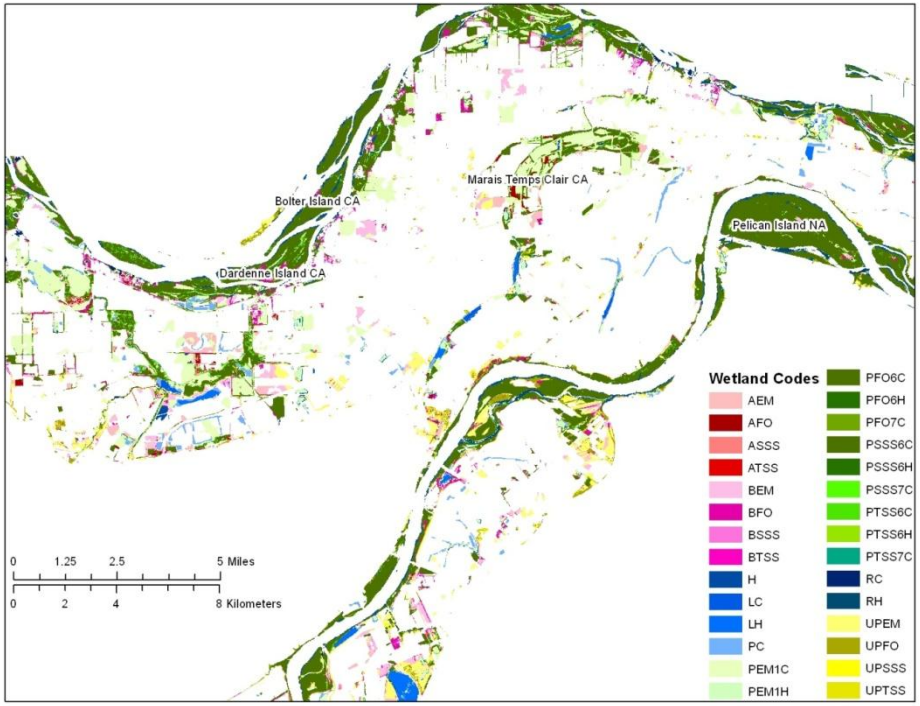






4. New Work

- Wetland Mitigation and Restoration
- Landcover Change Detection
- Missouri River Bottom Wetlands from LiDAR

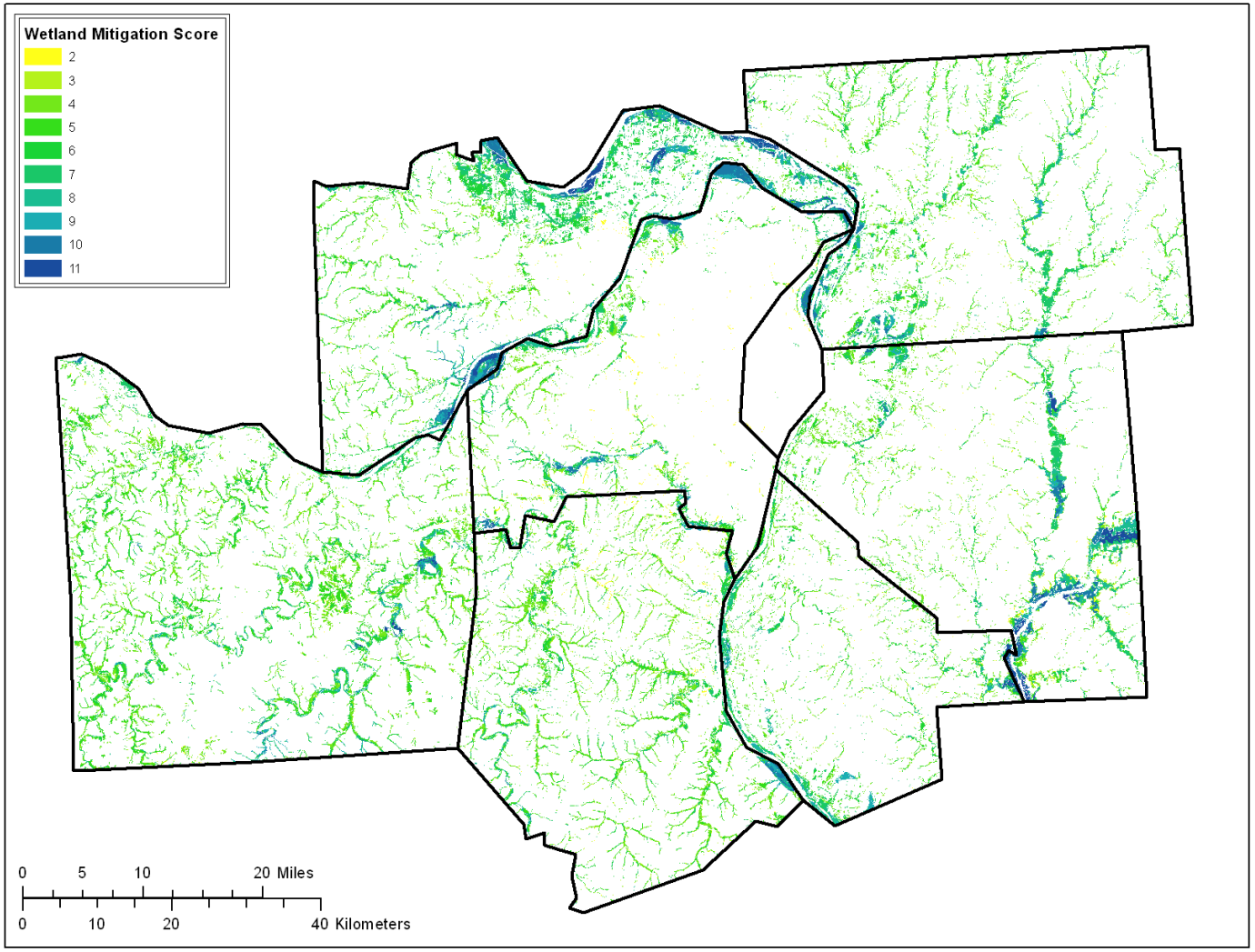


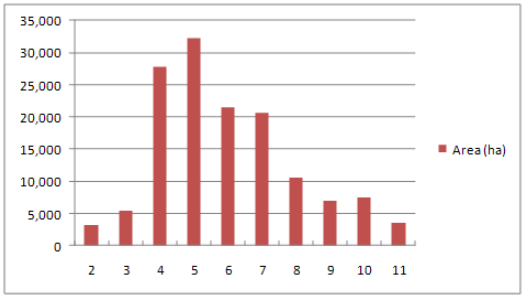
Wetland Mitigation versus Wetland Restoration

- We ranked all areas over bottomland soils as having either potential wetland mitigation value or potential wetland restoration value.
- Cropland, barren or sparsely vegetation land, and open water were ranked in terms of potential for restoration, and all other extant vegetation types were ranked in terms of potential for mitigation.
- In this regard, the terminology herein may not correspond with definitions used within regulatory contexts.

Previous Wetland Mitigation Model

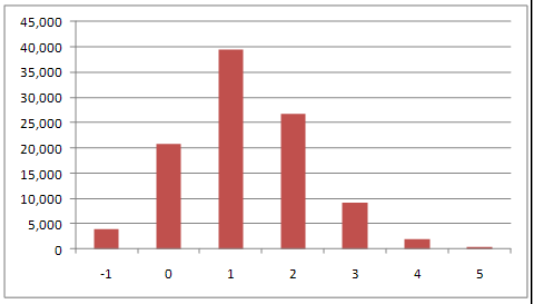
- Wetland Community Importance Rank
- Project-level Significance
- Public Lands
- Water
- Roads and Urban land cover

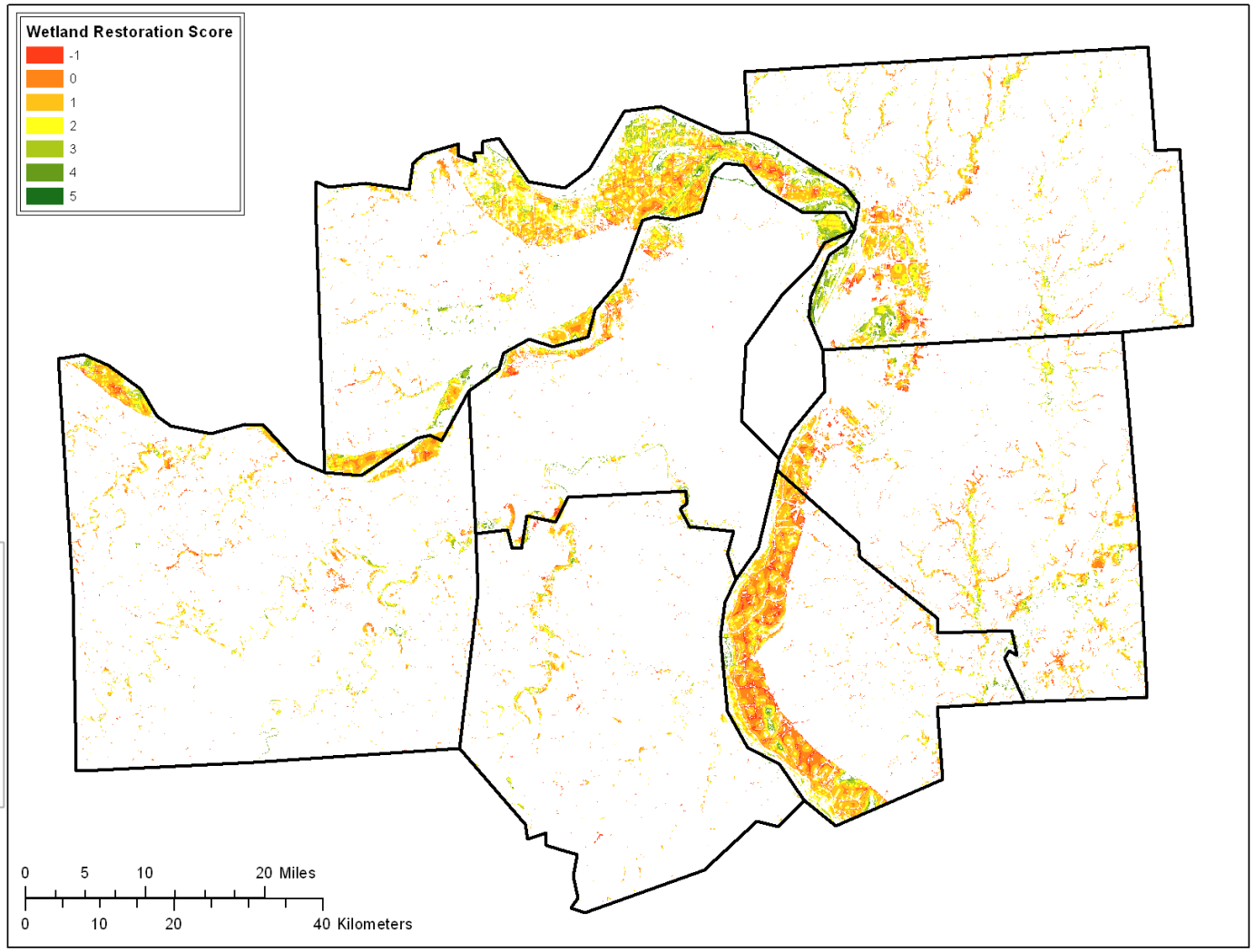




Previous Wetland Restoration Ranking

- Public Lands
- Proximity to Extant Wetlands
- Proximity to Water
- Proximity to Roads and Urban Areas





Limitations of Wetland Scoring

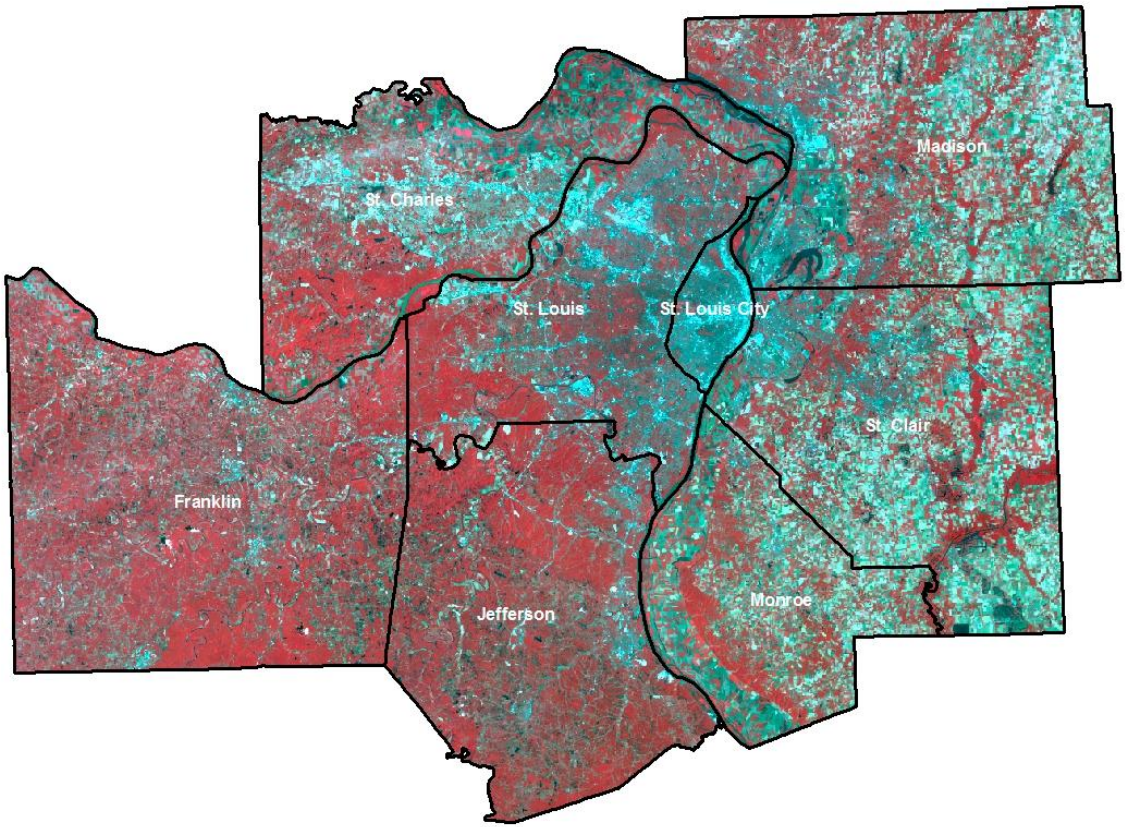
- Lack of information on hydrologic regime
- Lack of fine-resolution elevation data
- Lack of information on vegetation height and density

LULC Change

- 2008 – 2010 change detection
- 30 m Landsat TM imagery
  - Spring, Summer, and Fall imagery
- All crop classes as defined by 2008 Landfire Existing Vegetation Cover data layer were masked out
- Erdas Imagine DeltaCue

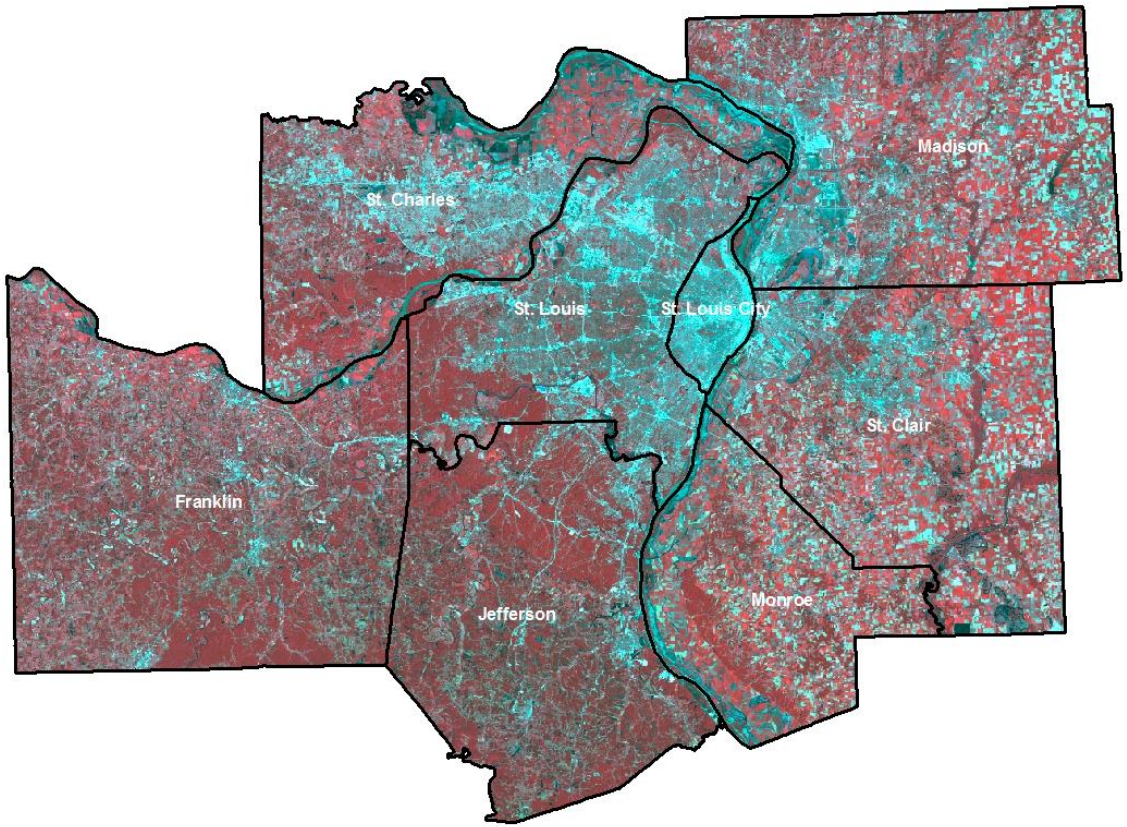
LULC Change

2008 Landsat Imagery



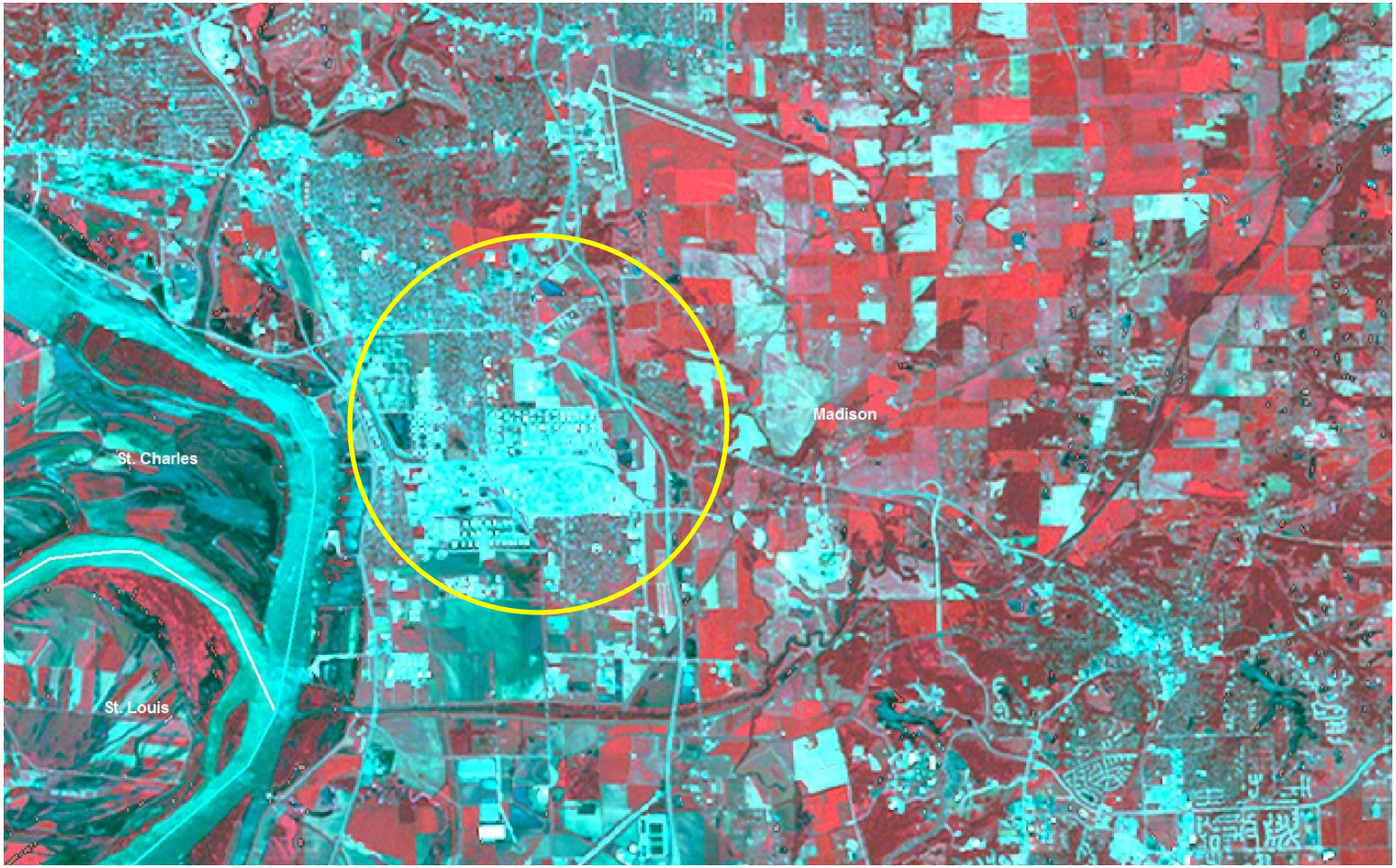
LULC Change

2010 Landsat Imagery

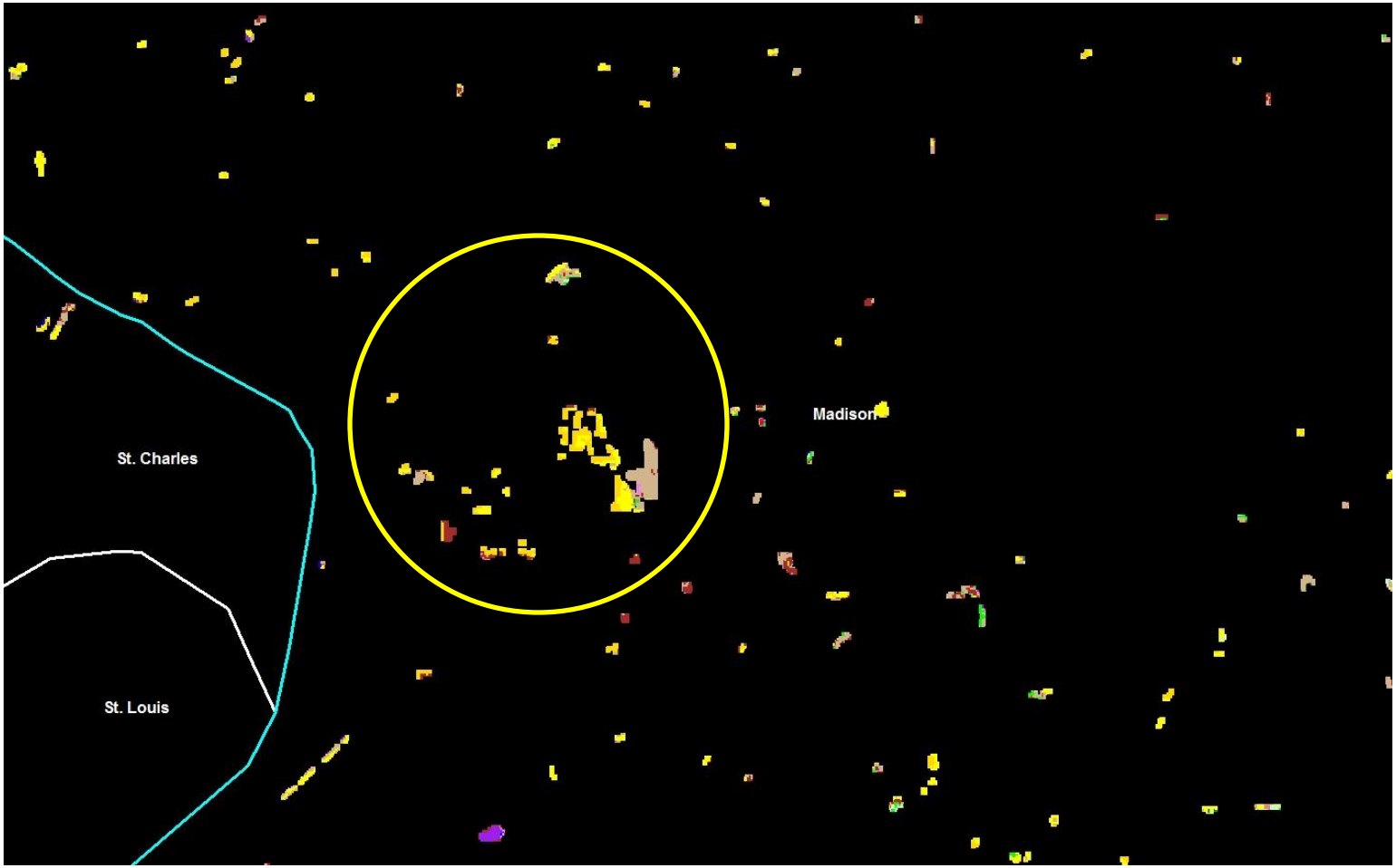


LULC Change

LULC Change



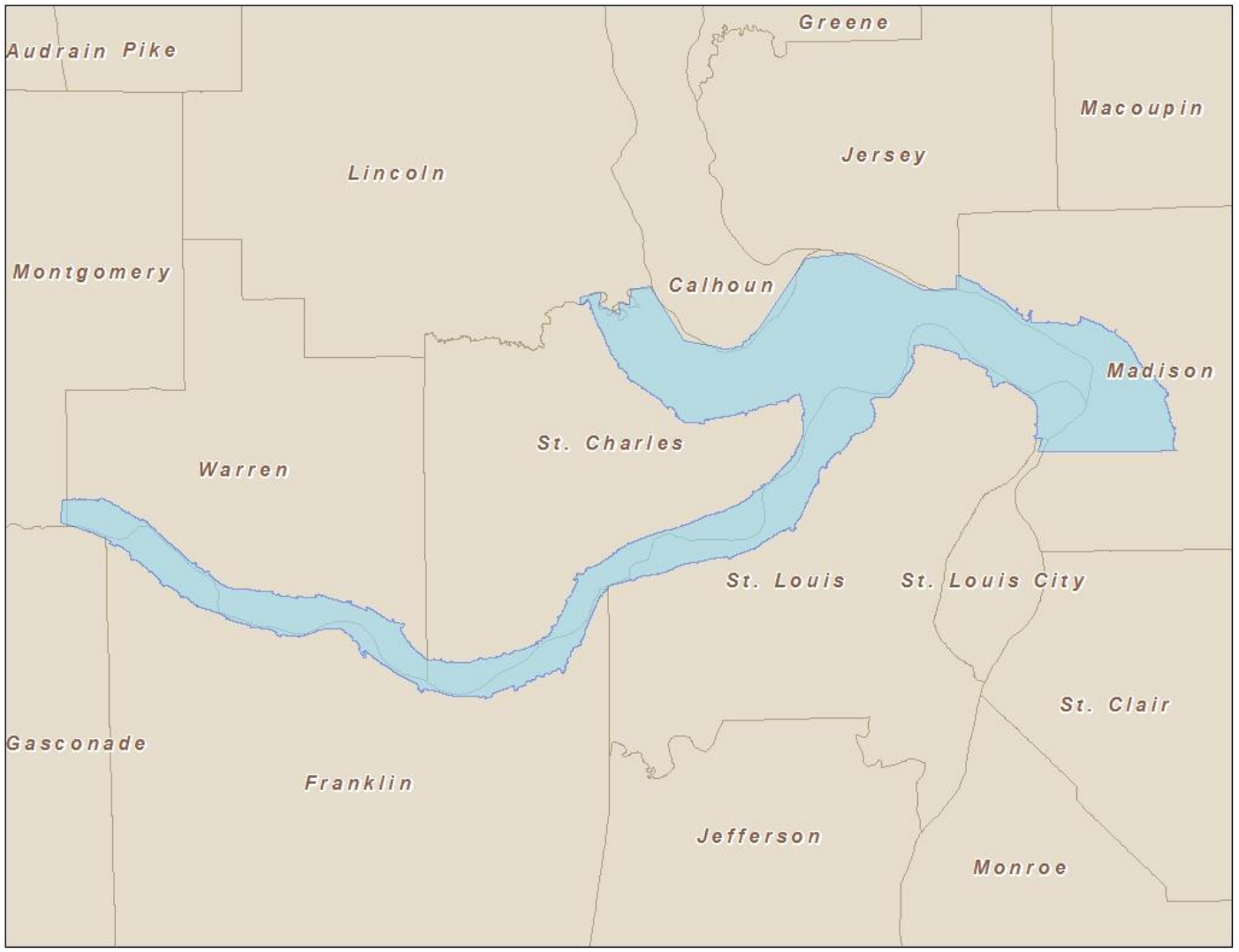
LULC Change



Goal

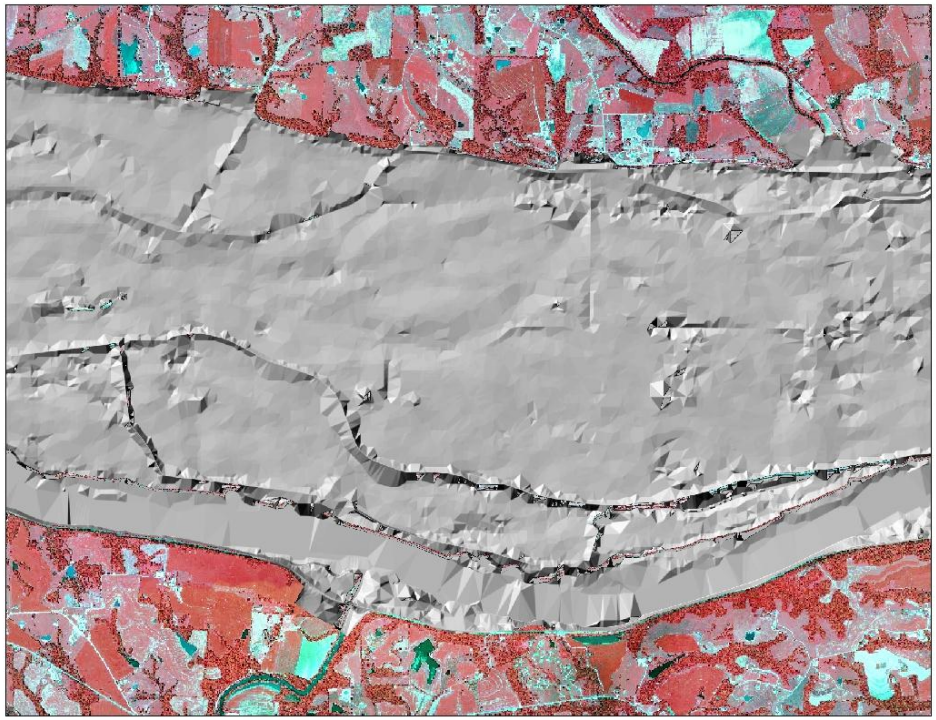
- Improve upon previous wetland delineation techniques by using LiDAR to provide
  - Finer spatial resolution DEM products
    - Digital Surface Model, vegetation height, sinks (local depressions)
  - Delineation of vegetation based on height and density
    - Herbaceous, shrub, and woodland

East-West Gateway Missouri River Wetlands Study Area

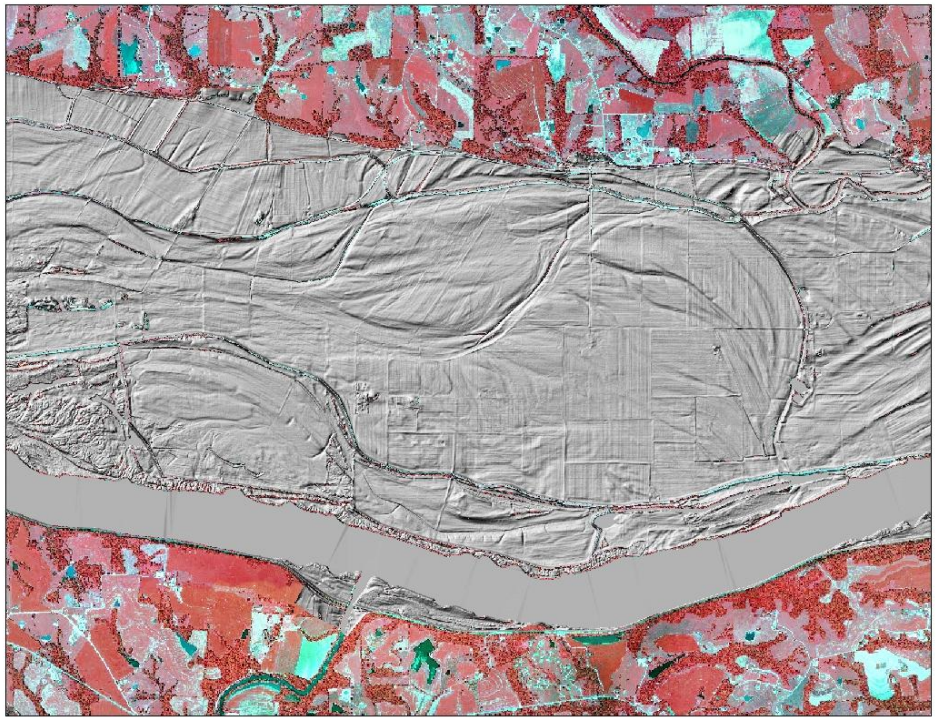


DEM Comparison

2006 COE 5 meter DEM

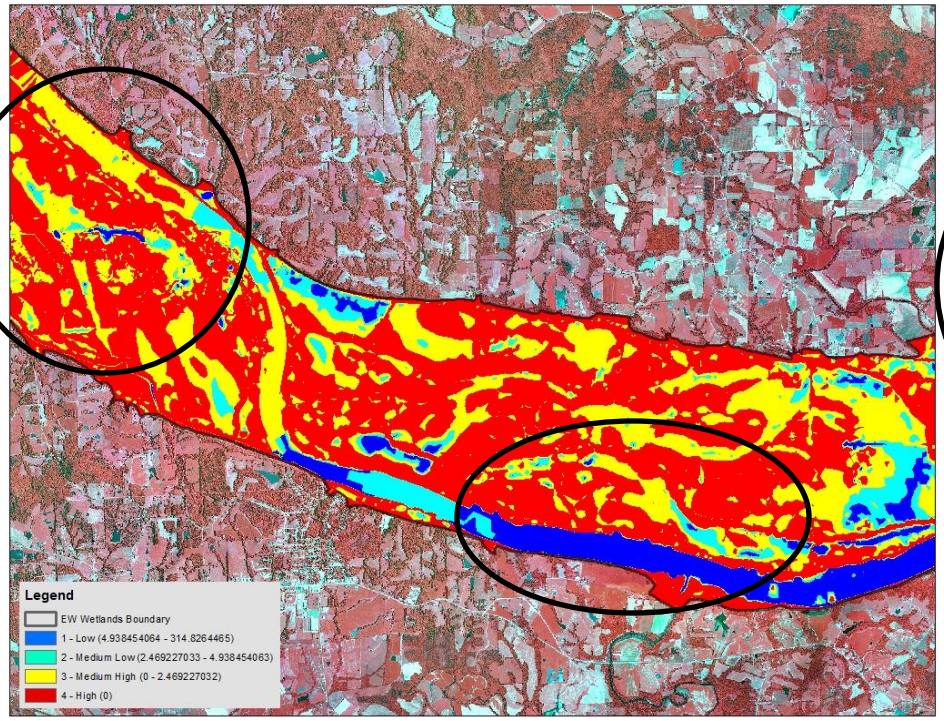


2008 – 2010 LiDAR 5 meter DEM

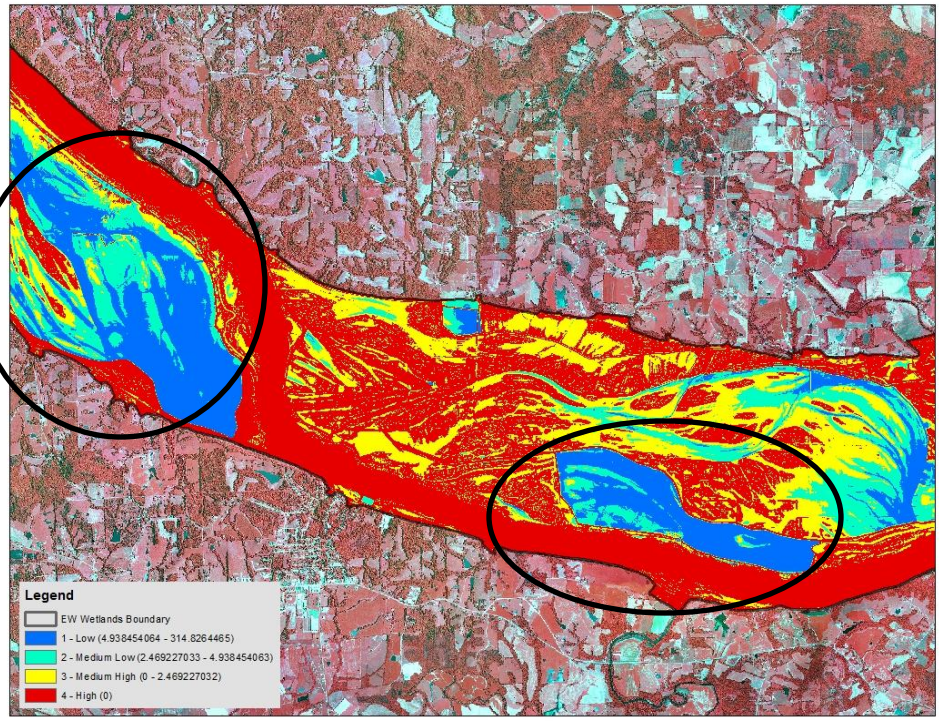


LiDAR vs. COE DEM Sinks Comparison

COE 5 m Sinks

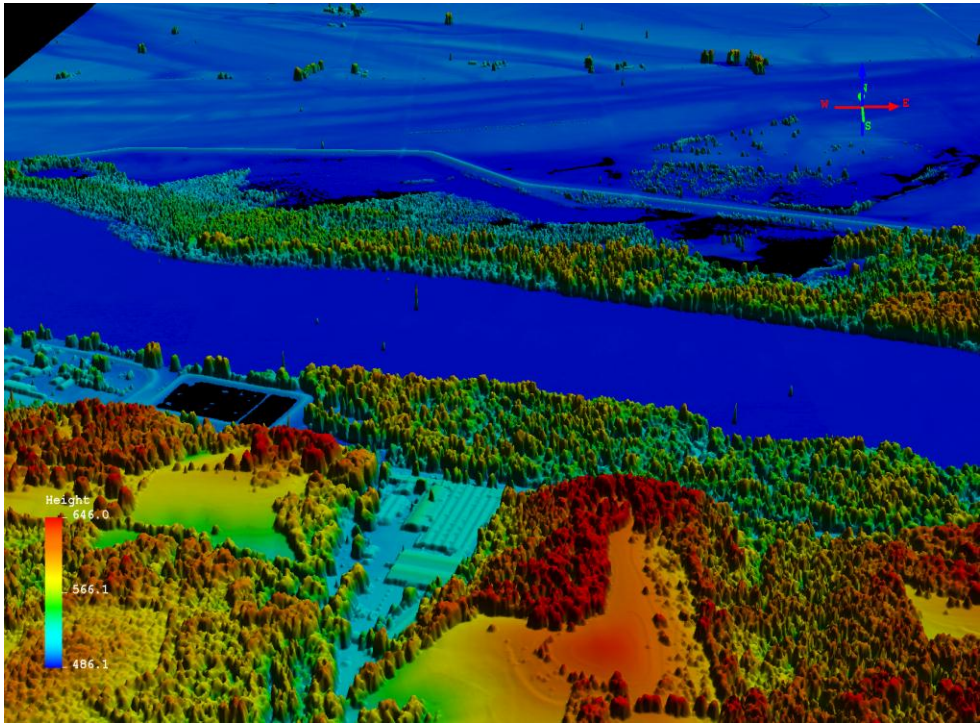


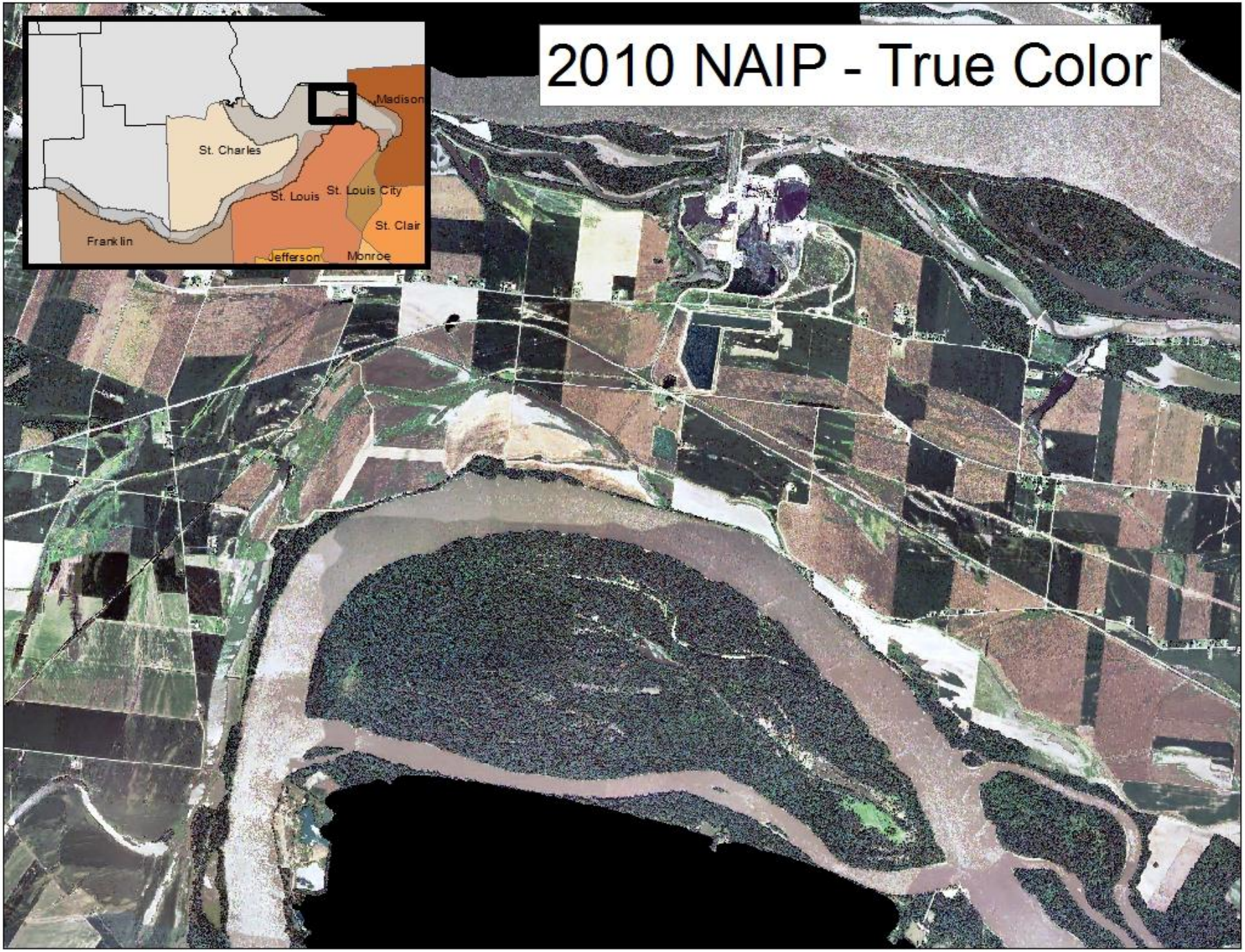
LiDAR 5 m Sinks

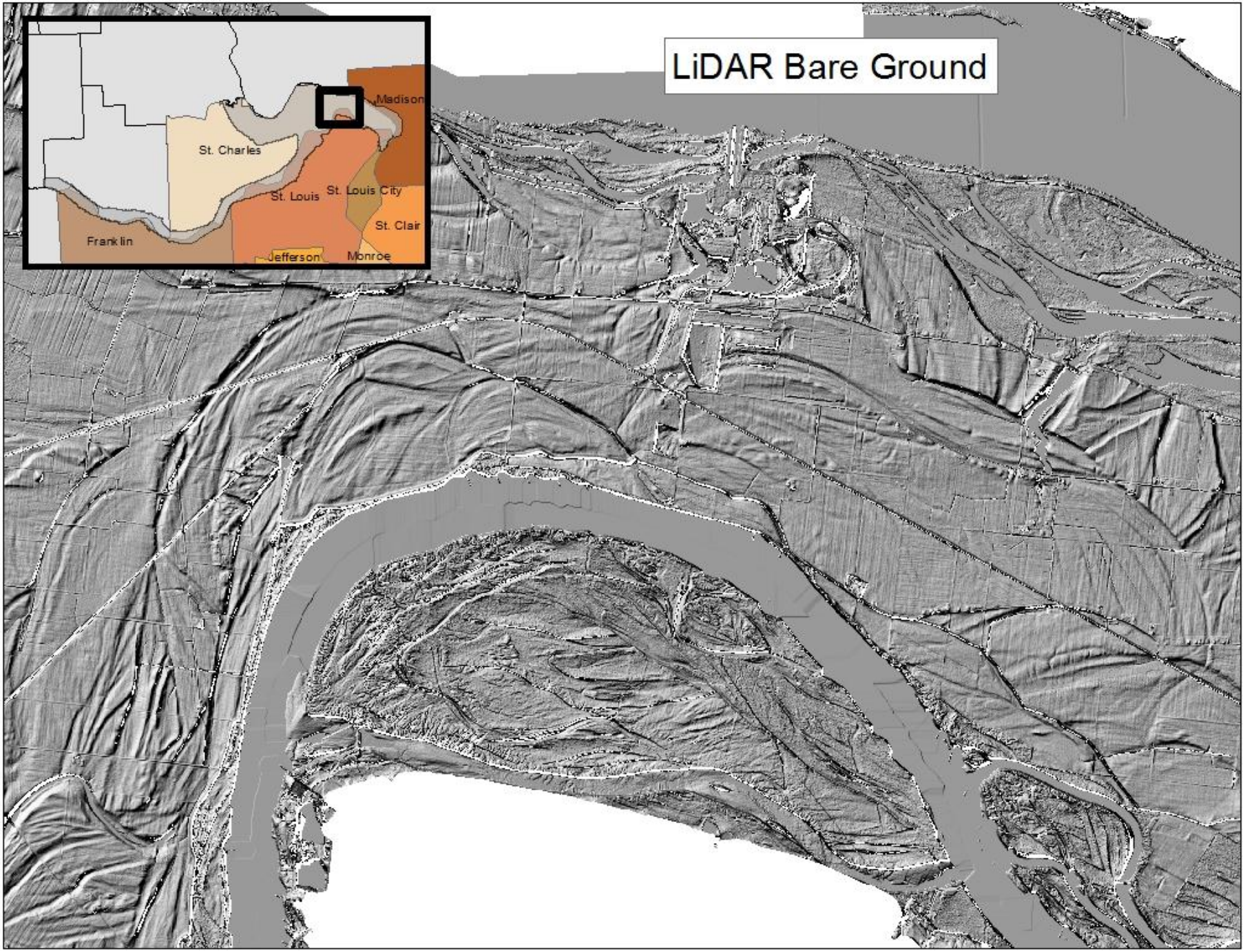


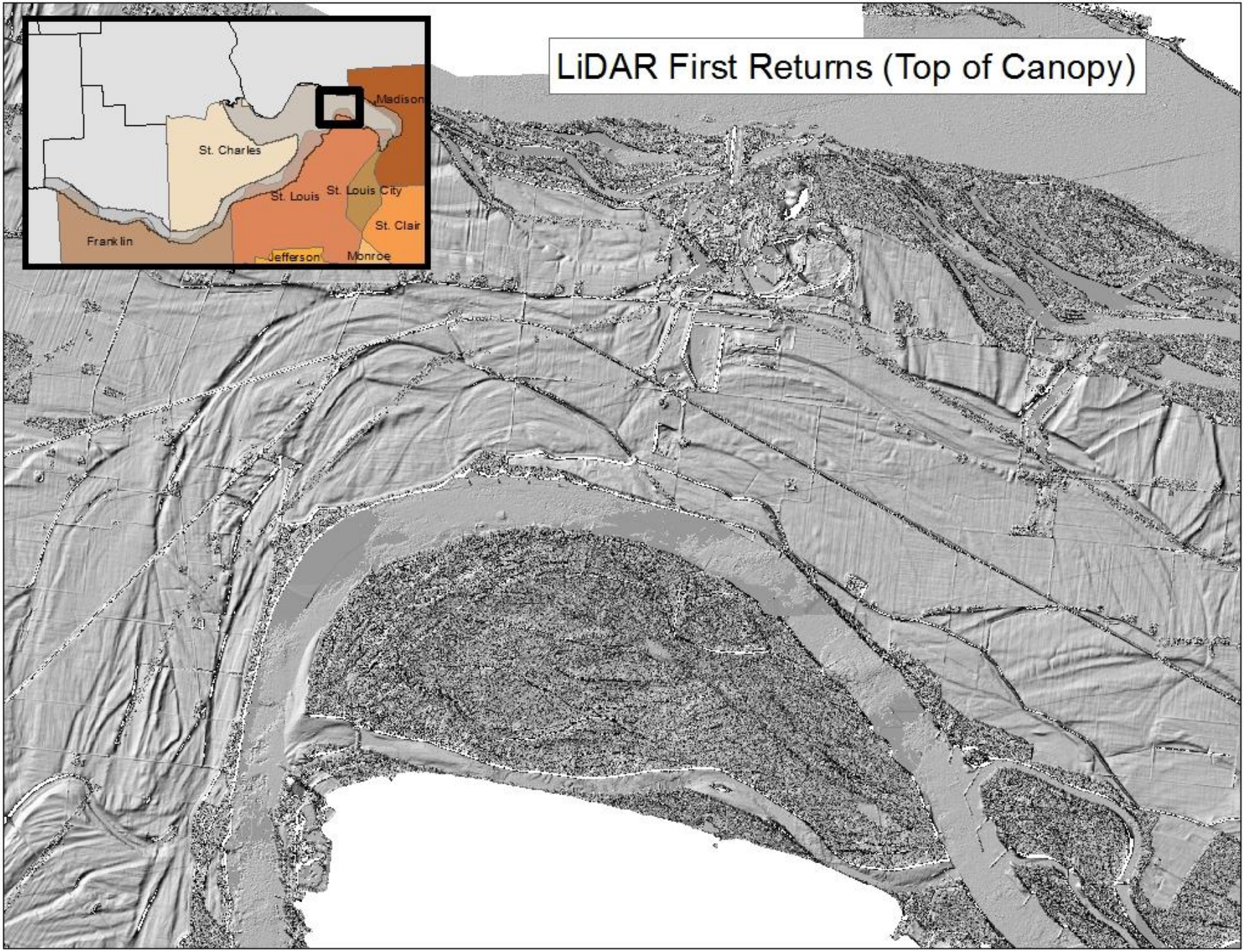
Current Wetland Vegetation Mapping Process

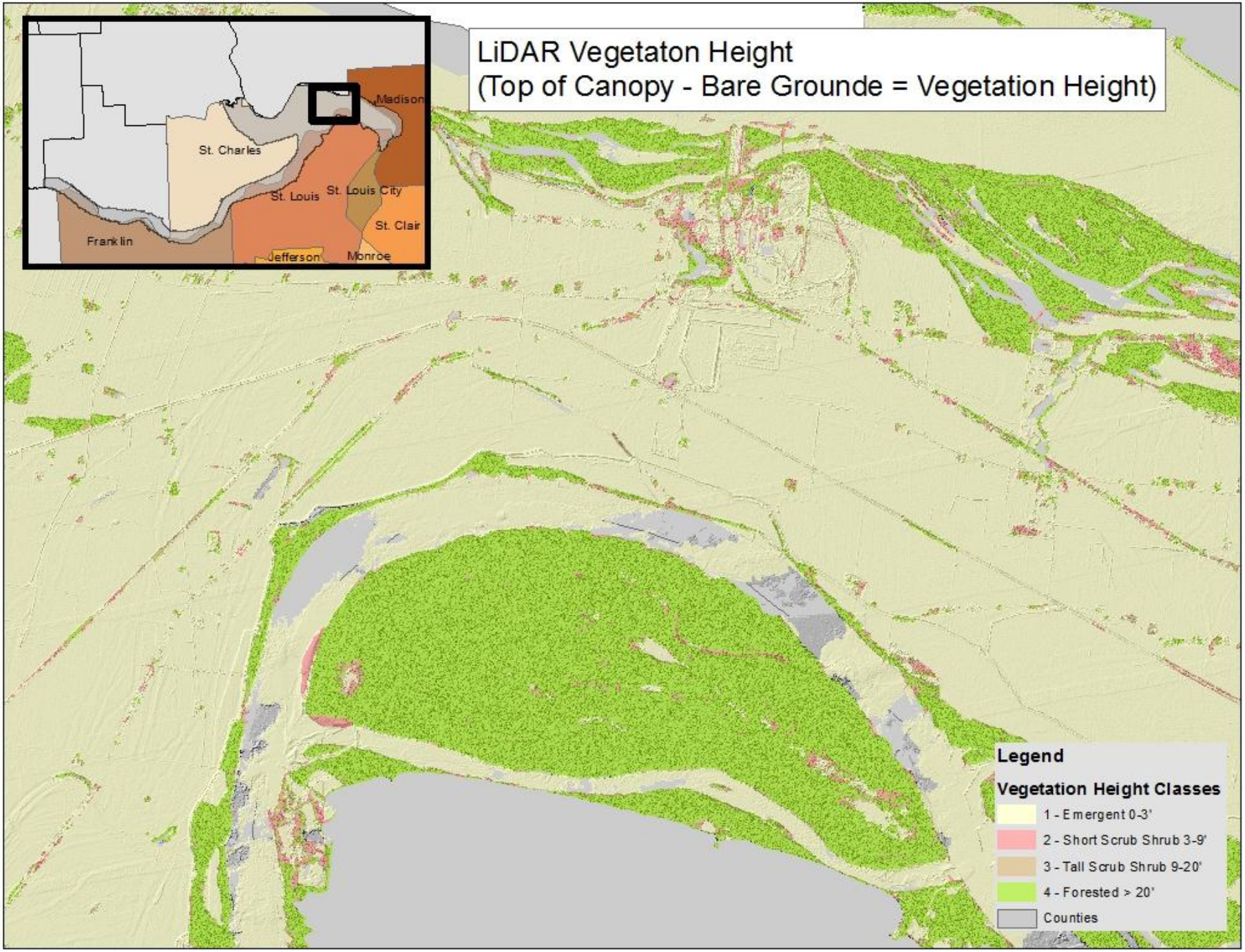
- Land Use Land Cover
- Vegetation Height
- Object delineation of homogeneous features on landscape



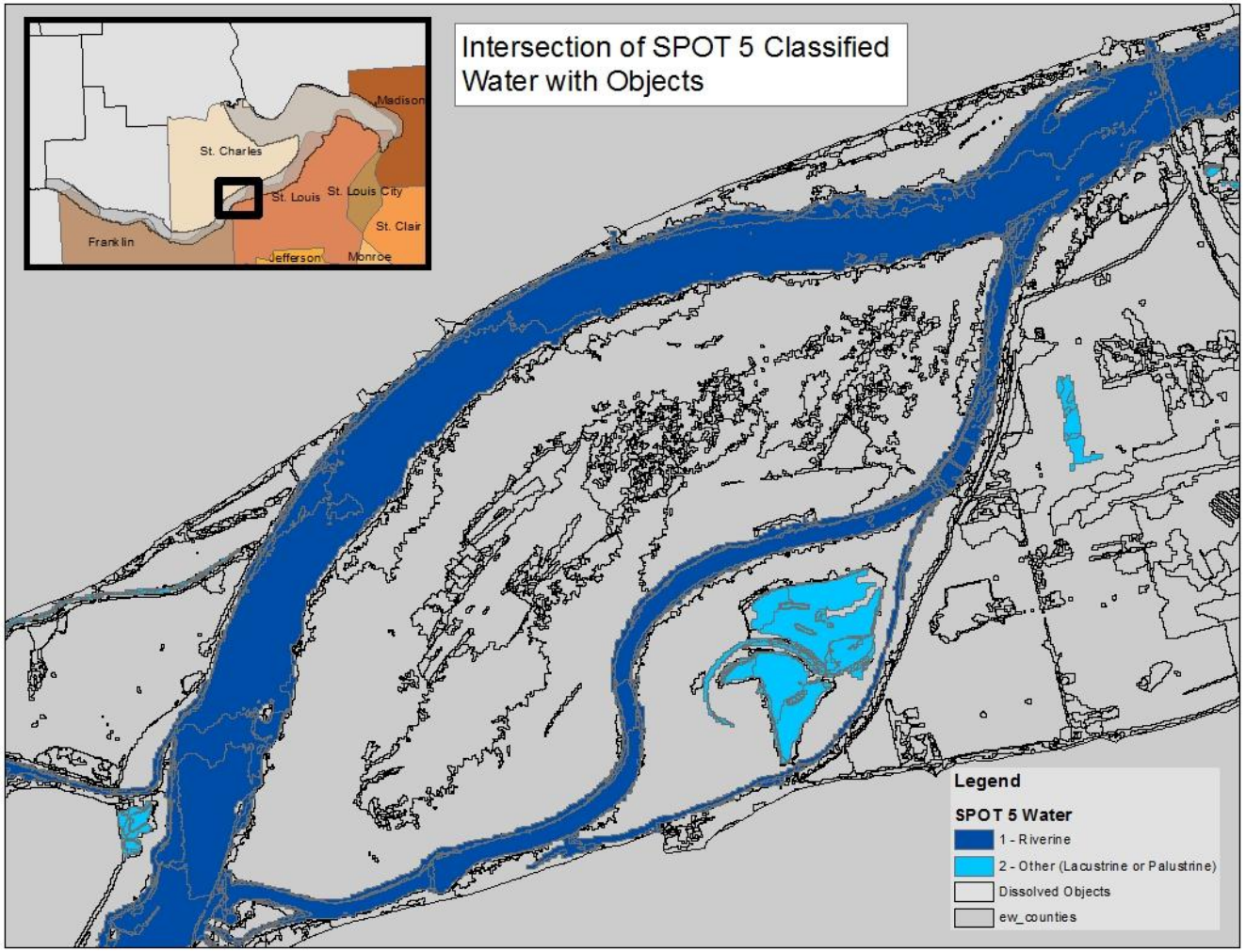

2010 NAIP - True Color
Madison
St. Charles
St. Louis
St. Louis City
St. Clair
Franklin
Jefferson
Monroe


LiDAR Bare Ground
Madison
St. Charles
St. Louis
St. Louis City
St. Clair
Franklin
Jefferson
Monroe

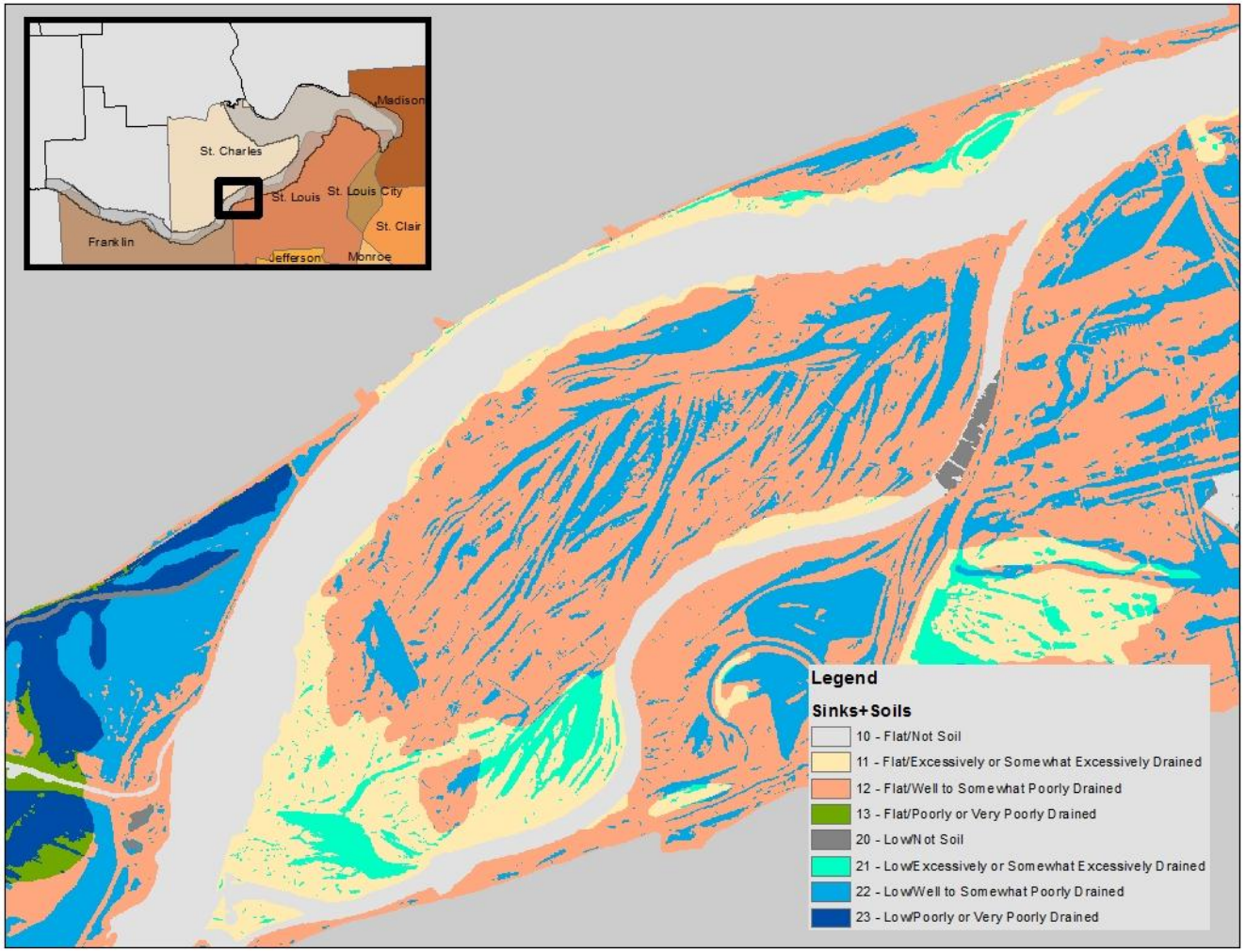

LiDAR First Returns (Top of Canopy)
Madison
St. Charles
St. Louis
St. Louis City
St. Clair
Franklin
Jefferson
Monroe


LiDAR Vegetaton Height
(Top of Canopy - Bare Grounde = Vegetation Height)
Madison
St. Charles
St. Louis
St. Louis City
St. Clair
Franklin
Jefferson
Monroe
Legend
Vegetation Height Classes
1 - Emergent 0-3'
2 - Short Scrub Shrub 3-9'
3 - Tall Scrub Shrub 9-20'
4 - Forested > 20'
Counties

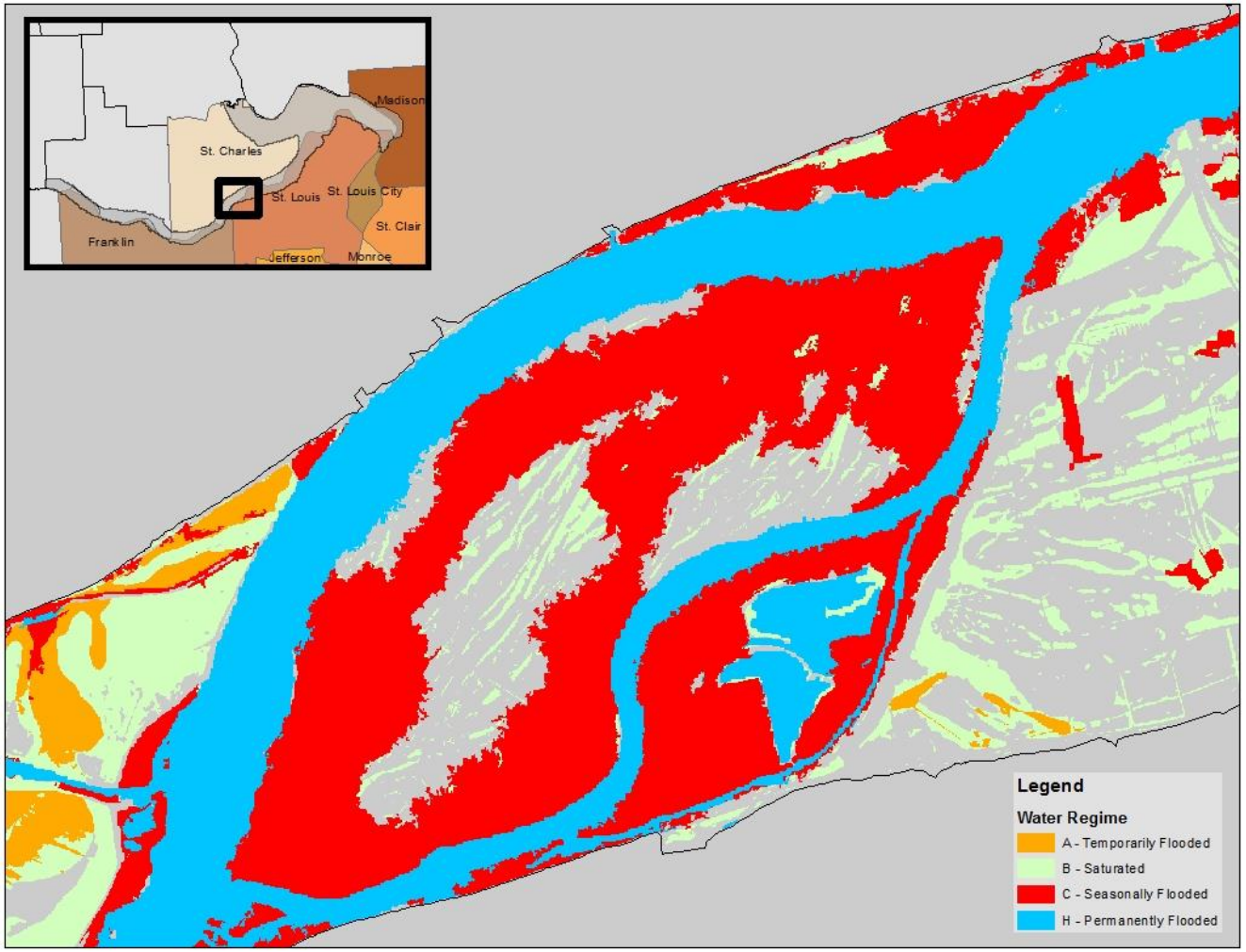
System - SPOT 5 Water



Water Regime – Sinks+Soils

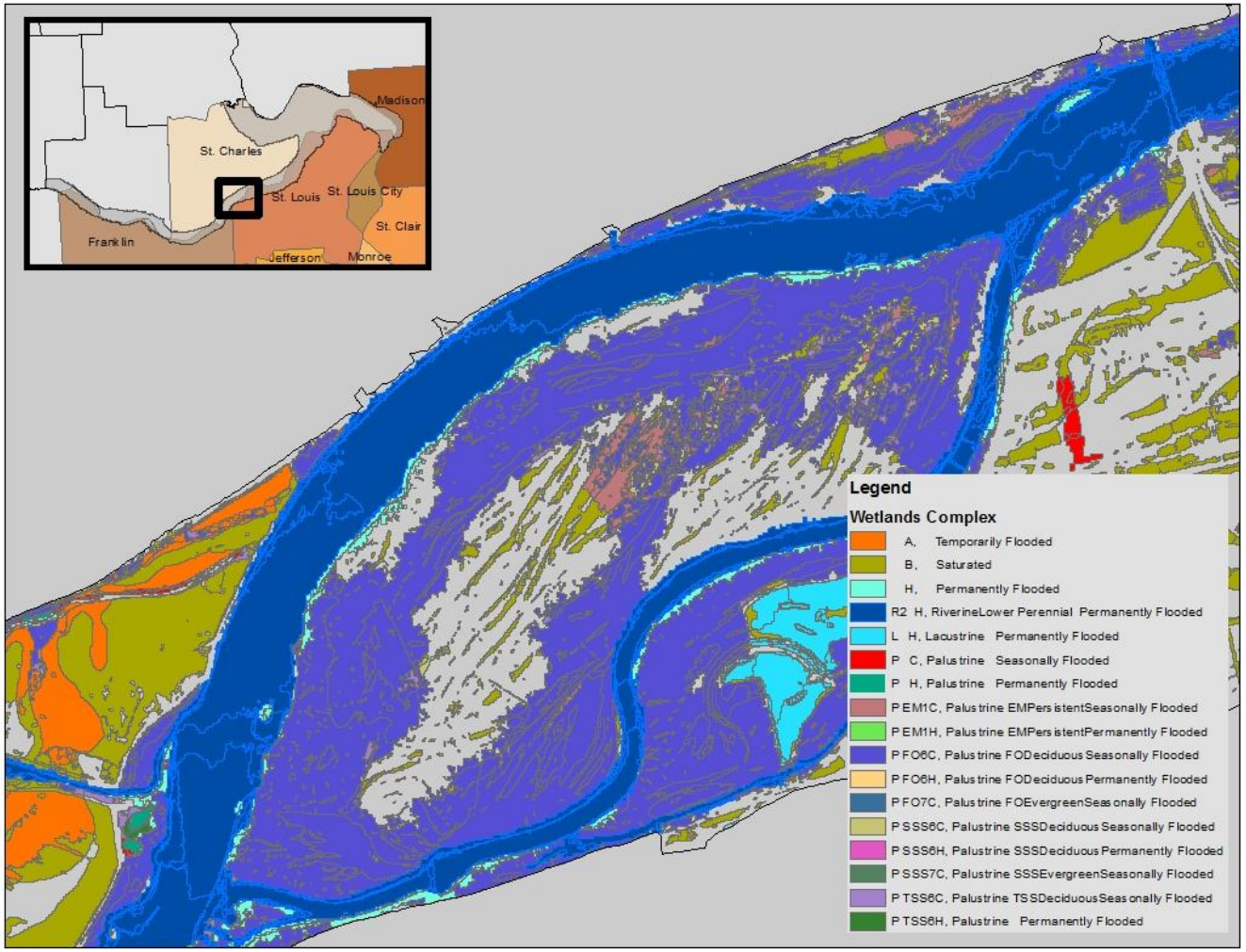


Water Regime – Sinks+Soils



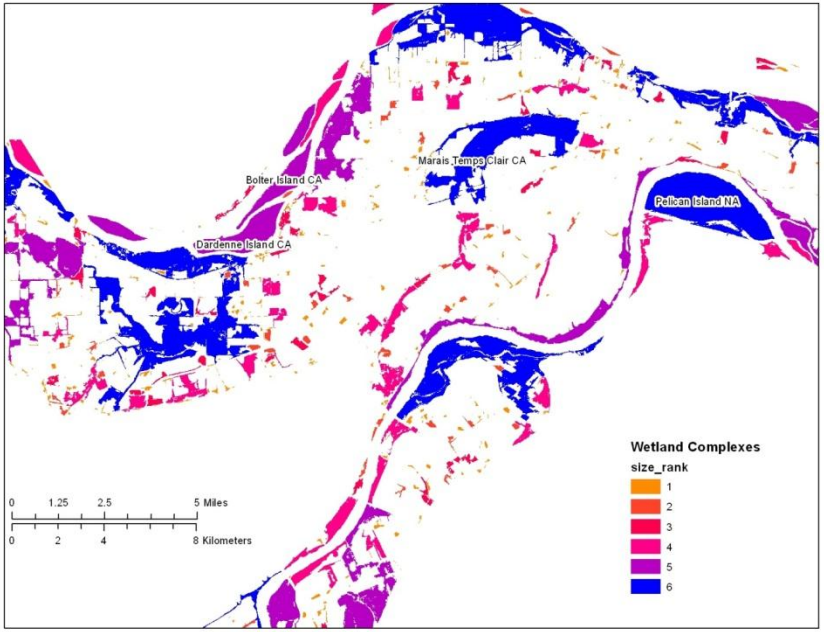
Wetland Classification

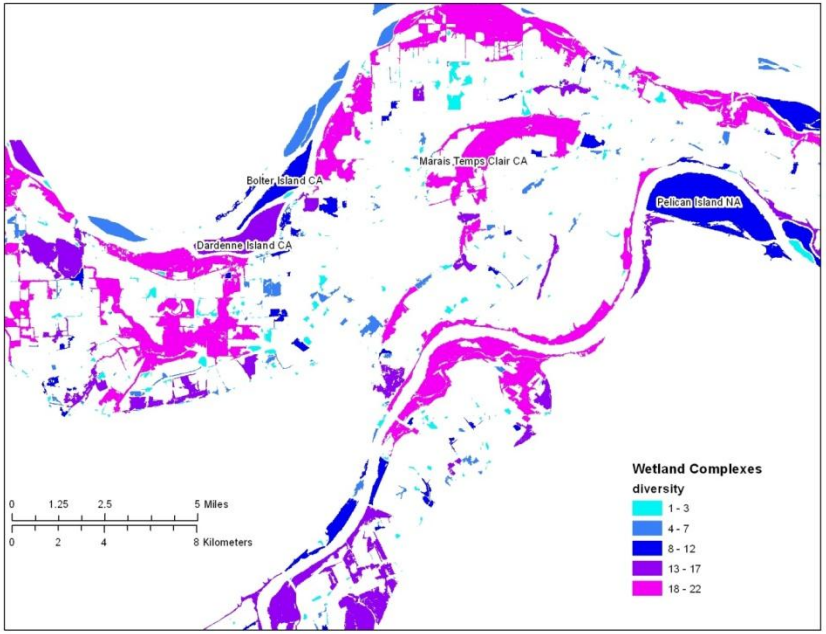
- Attributes for System, Subsystem, Class, Subclass, and Water Regime were concatenated to create Cowardin NWI classifications



Create Wetland Complexes

- Remove big rivers
- Remove unwanted uplands (Urban, Crop, and Barren)
- Dissolve Palustrine, Saturated, and Temporarily Flooded vegetated
- Select upland vegetated that touches complexes
- Select smaller water that touches complexes





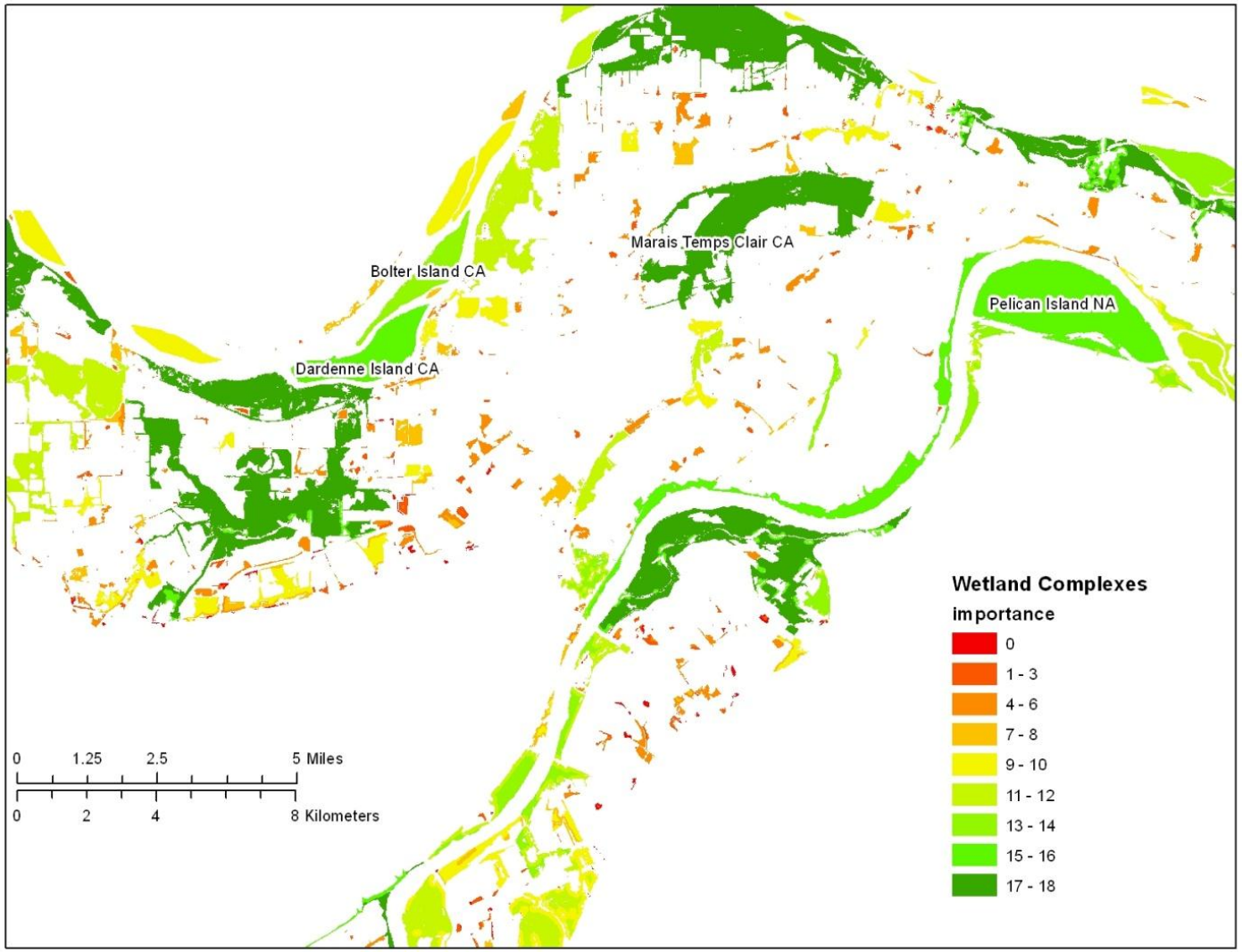
Wetland Complex Importance

Weighted Patch Size

Diversity

Distance to Protected Lands

Distance to Urban Lands



Wetland Restoration Rank

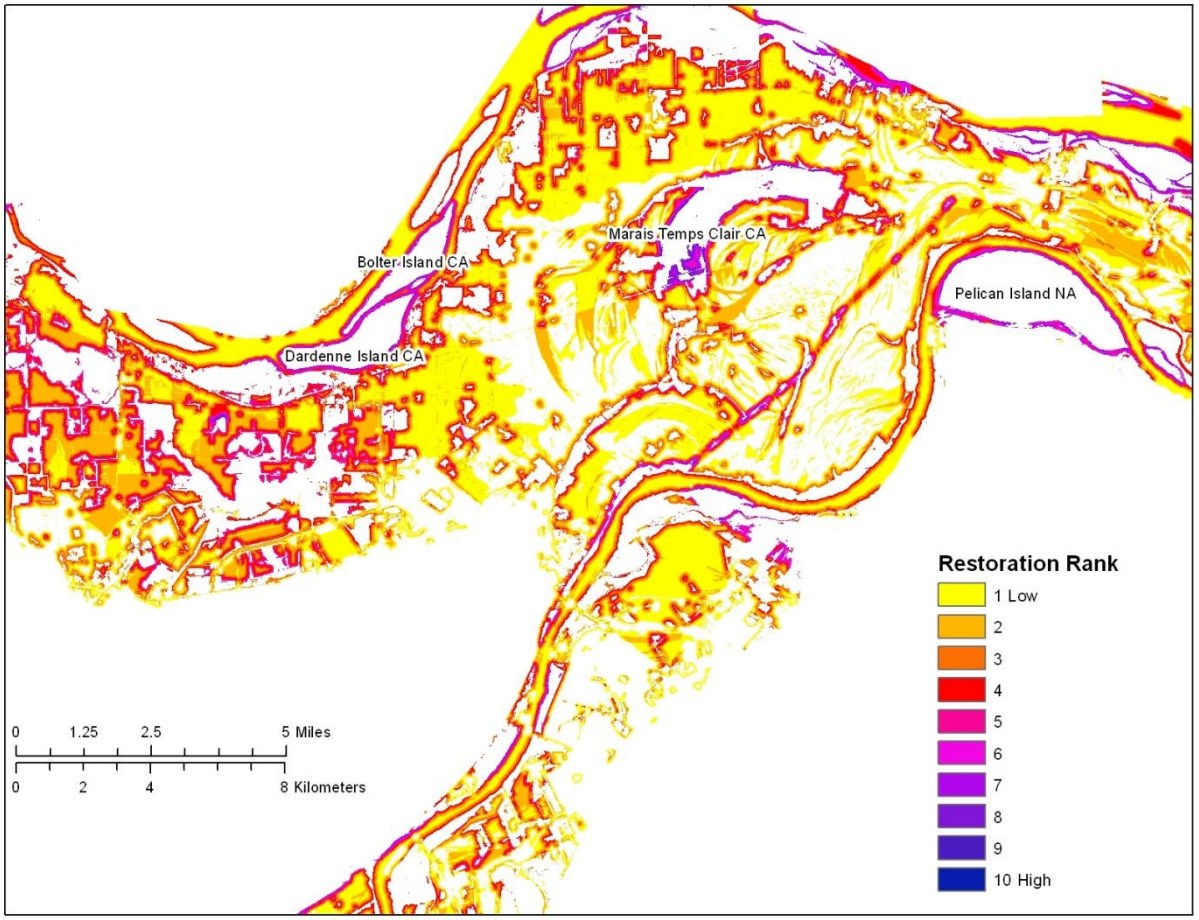
Water Regime

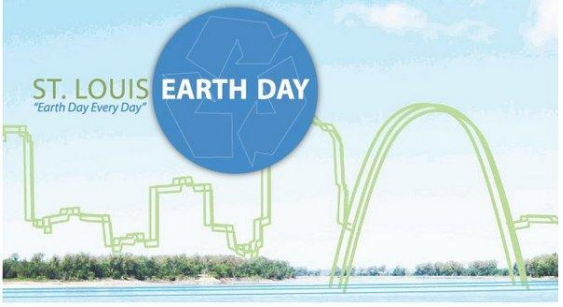
Distance to Protected Lands

Distance to Urban Lands

Distance to Water

Distance to Existing Wetlands





Available Data

- Current Vegetation
- Vegetation Interpretive Guide
- Regional Ecological Significance
- Regional Ecological Significance Report
- Project-level Ecological Significance

EAST-WEST GATEWAY
Council of Governments

MoRAP