



Creati

EAST-WEST GATEWAY
Council of Governments



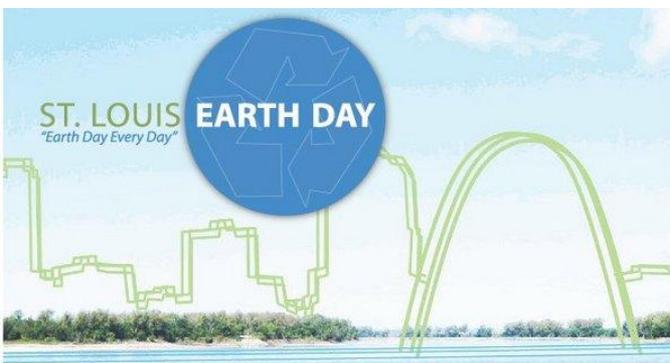
Creation of the Landcover and Natural Communities Database

April 6, 2012

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Missouri Resource Assessment Partnership (MoRAP)

University of Missouri

Contact: truecd@missouri.edu



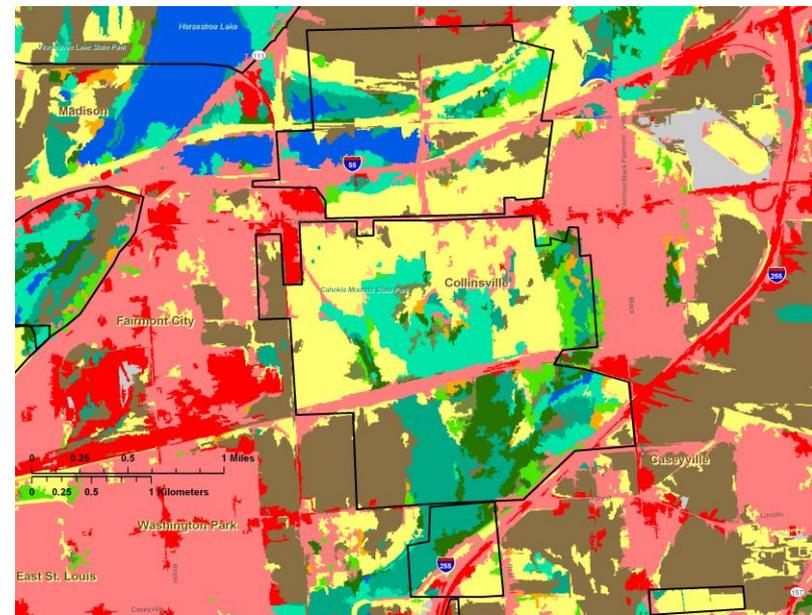
Presentation Outline

The background of the slide is a photograph of the St. Louis skyline. The Gateway Arch is the central focus, arching over the city. In the background, several skyscrapers are visible, including the AT&T Tower and the Old Courthouse. The sky is clear and blue.

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

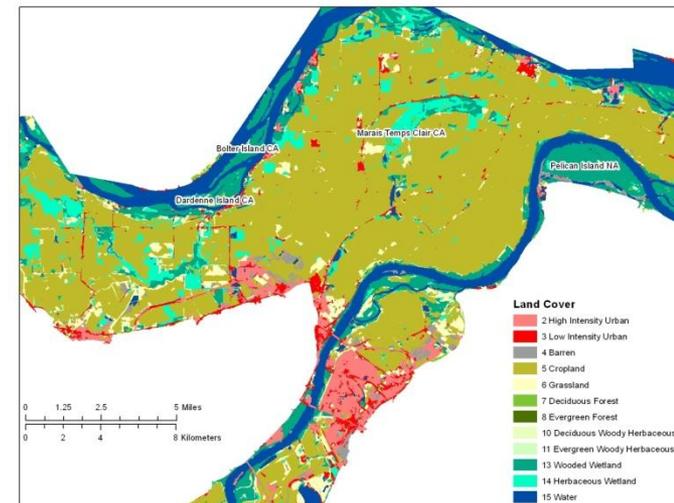
1. Vegetation Mapping

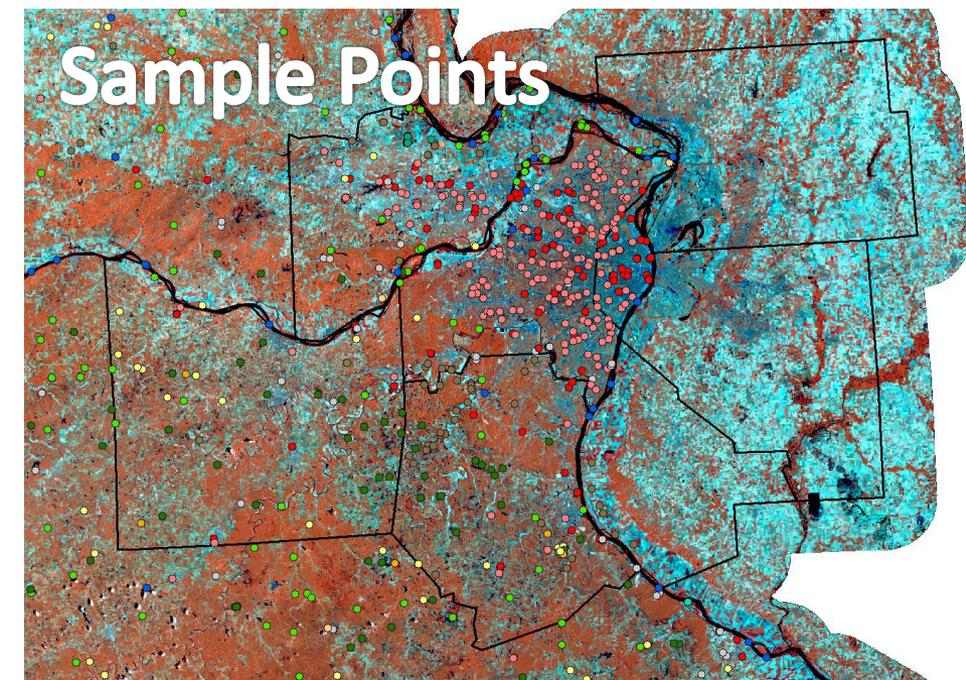
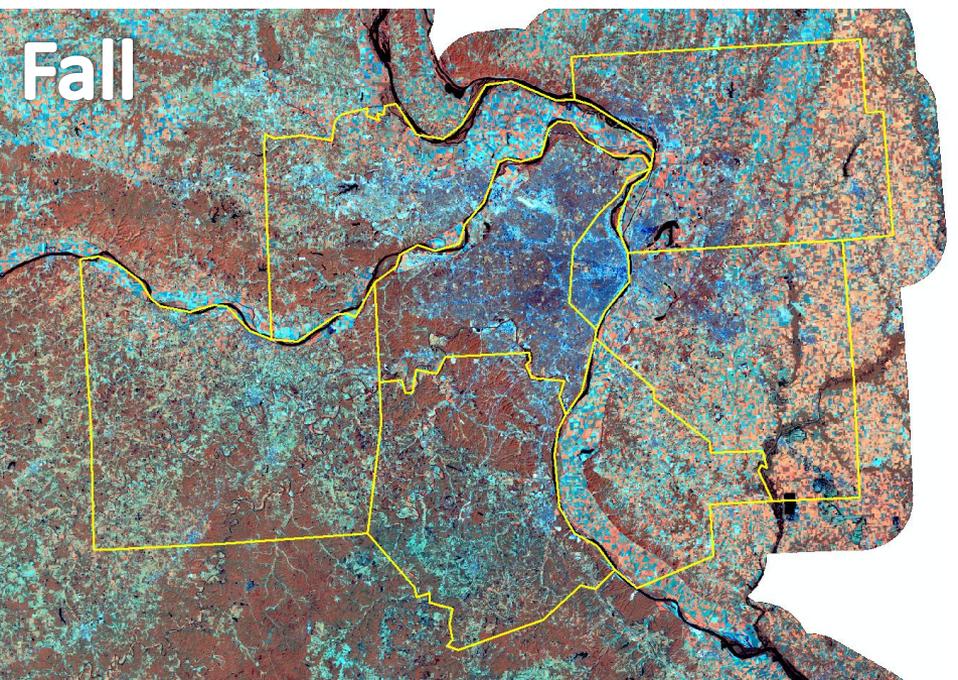
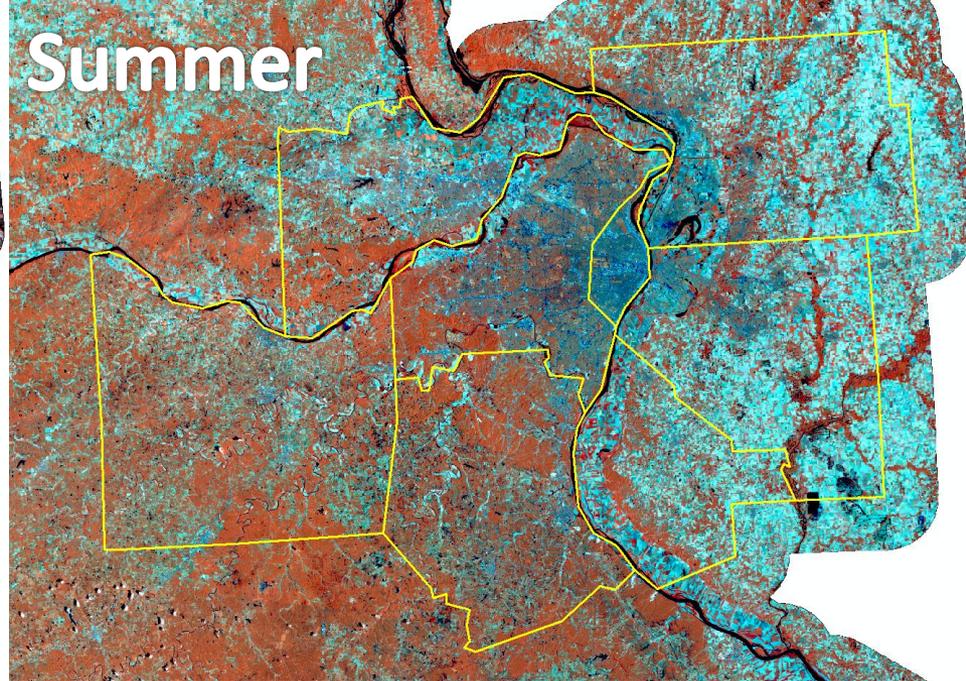
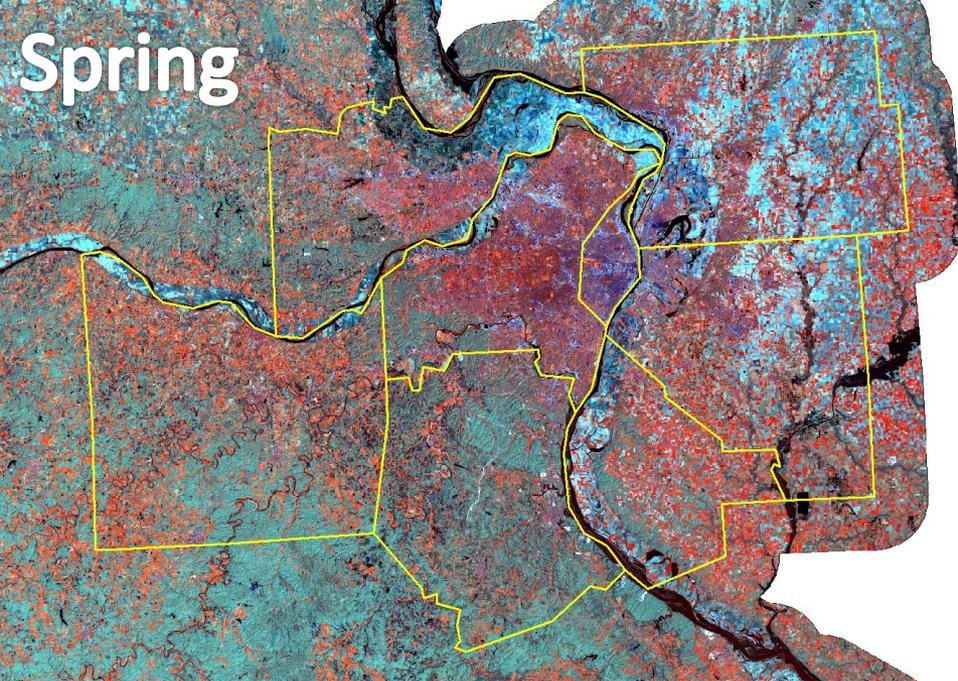
- Land cover data from satellite imagery
- Object creation from NAIP
- ELT's and Ancillary Data
- High Resolution Vegetation

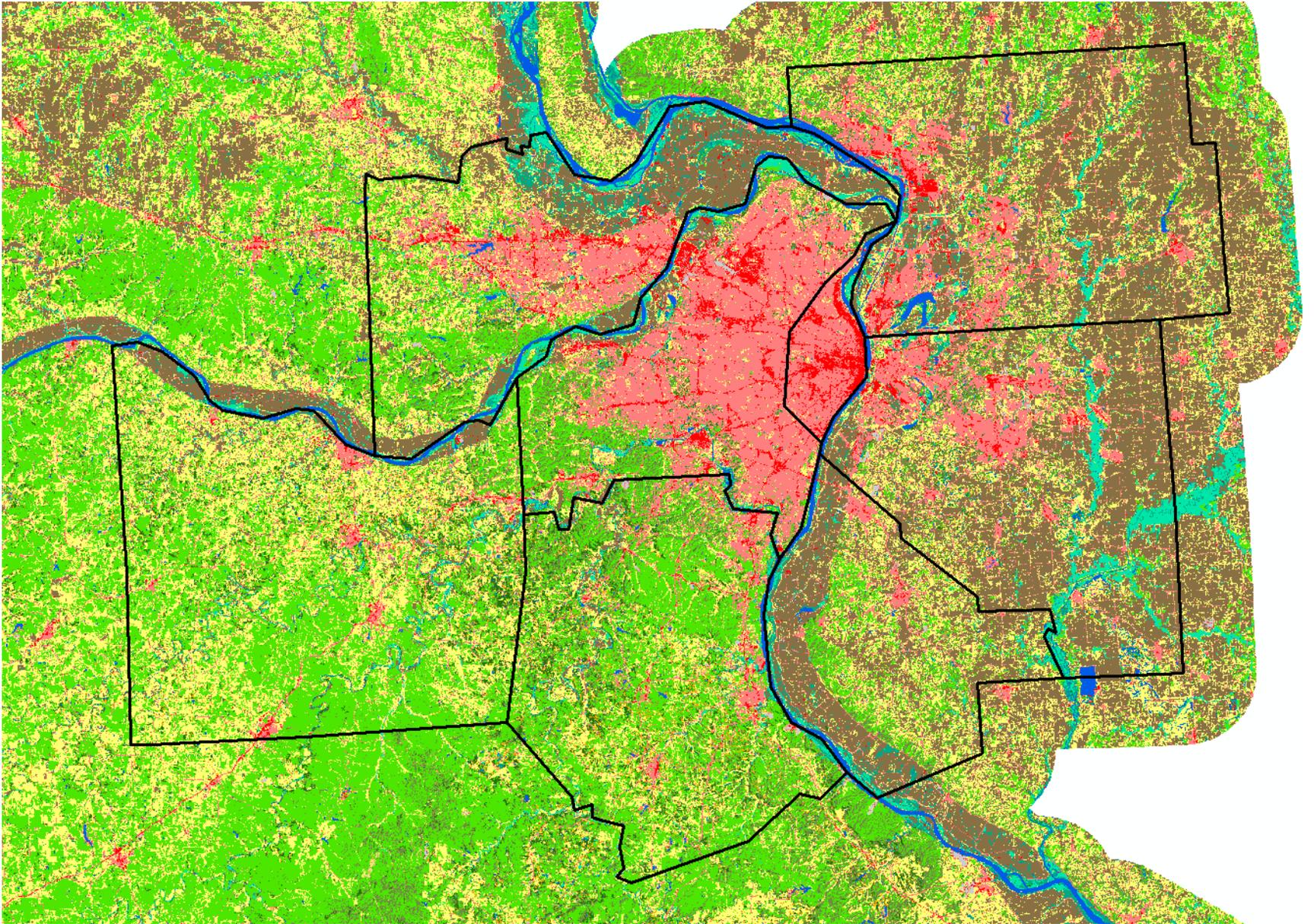


Land cover data from satellite imagery

- 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







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

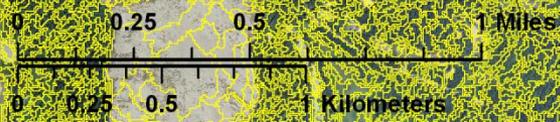


Pelican Island

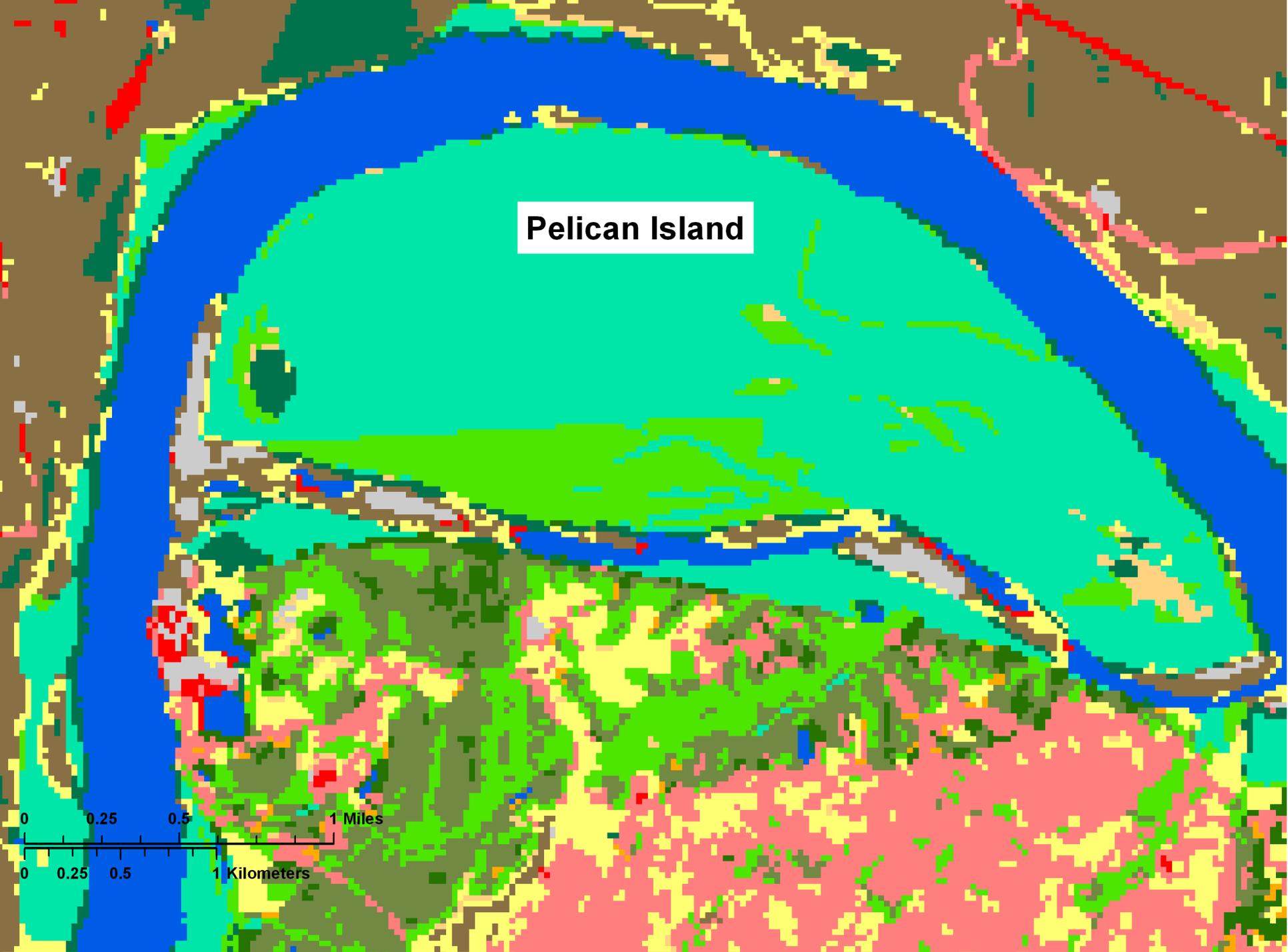
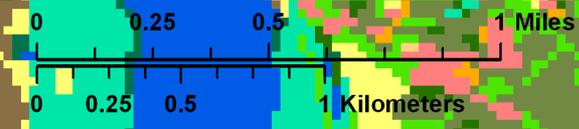
0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

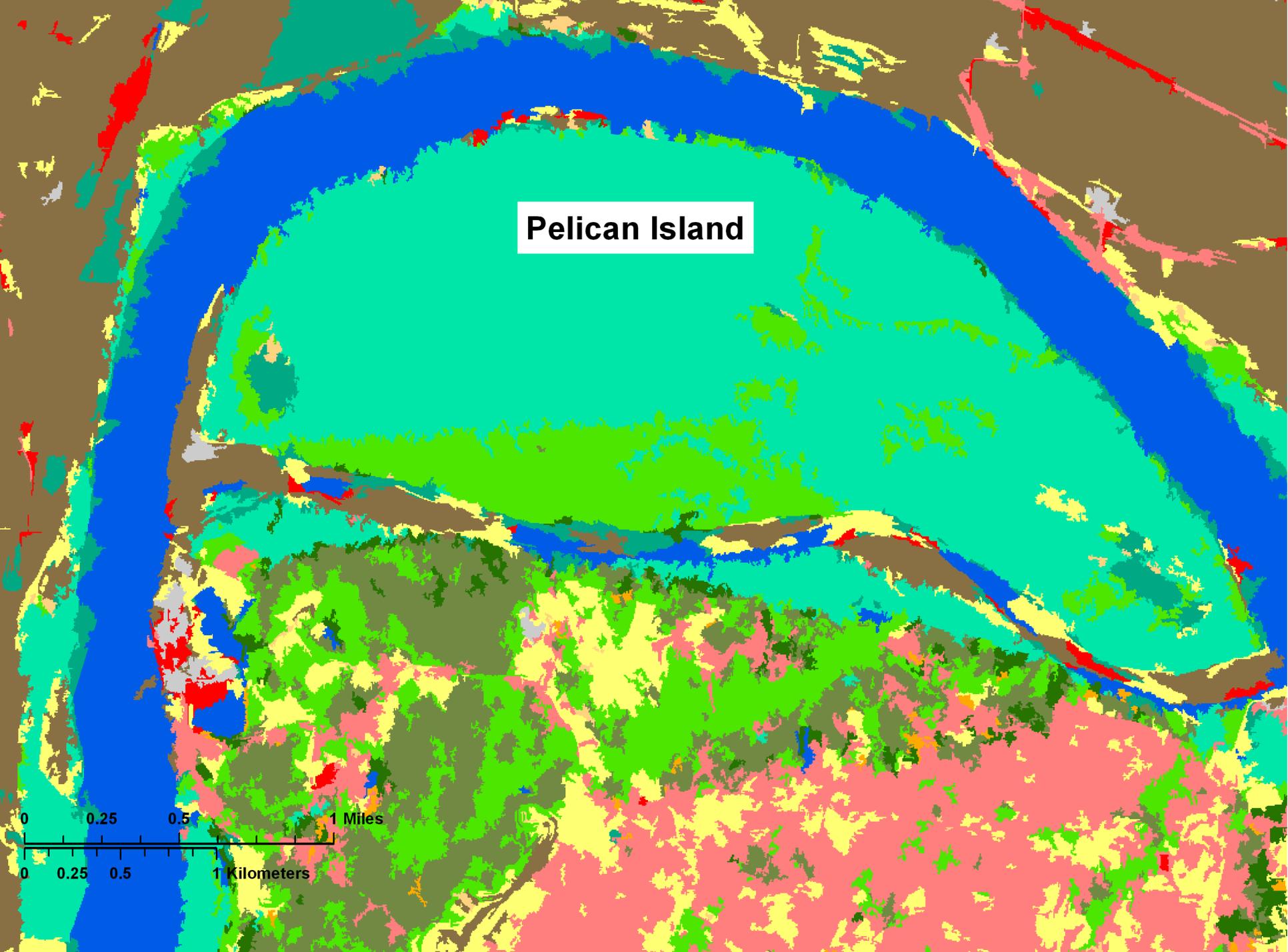
Pelican Island



Pelican Island



Pelican Island

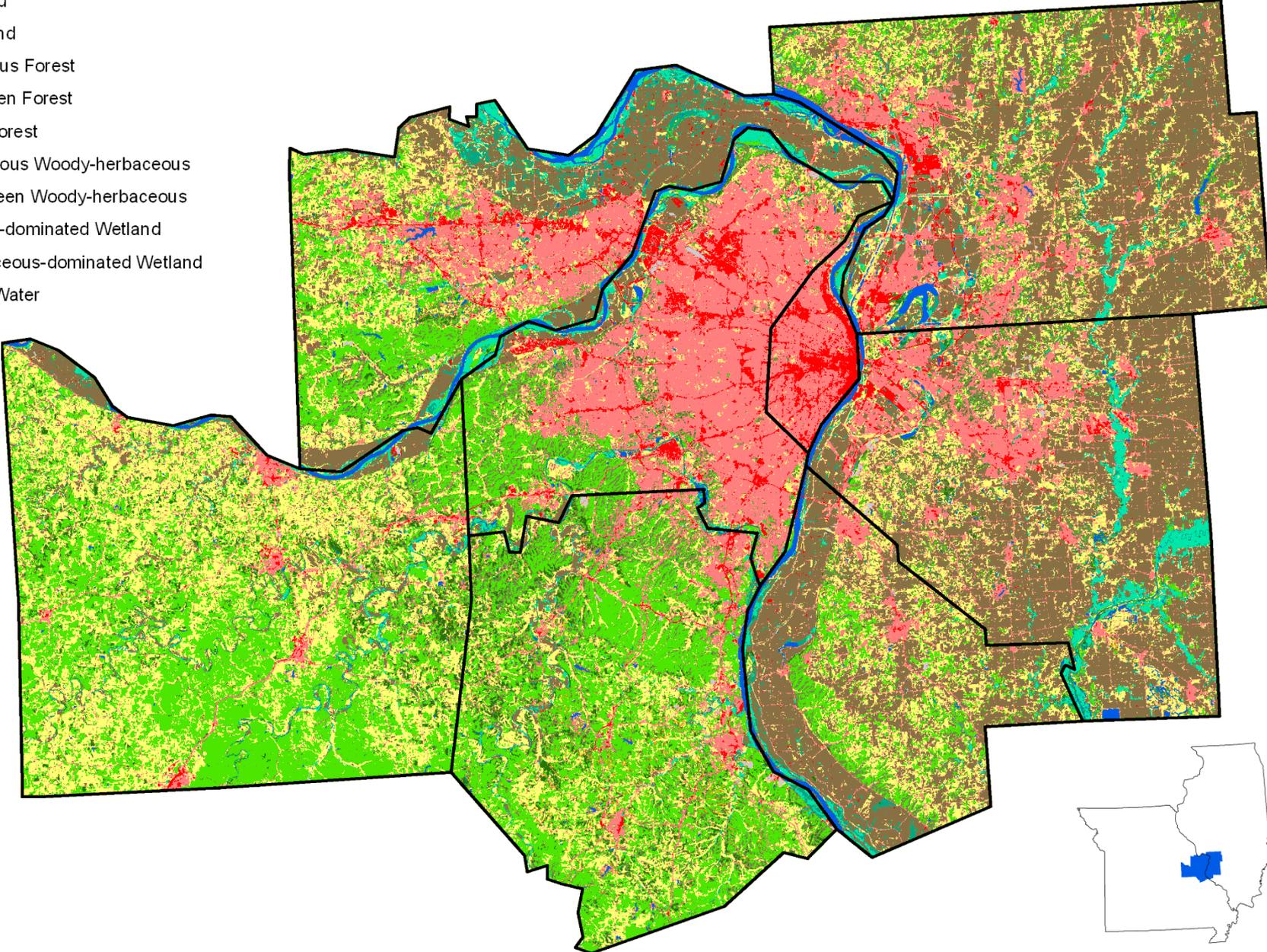


0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Current Land Cover

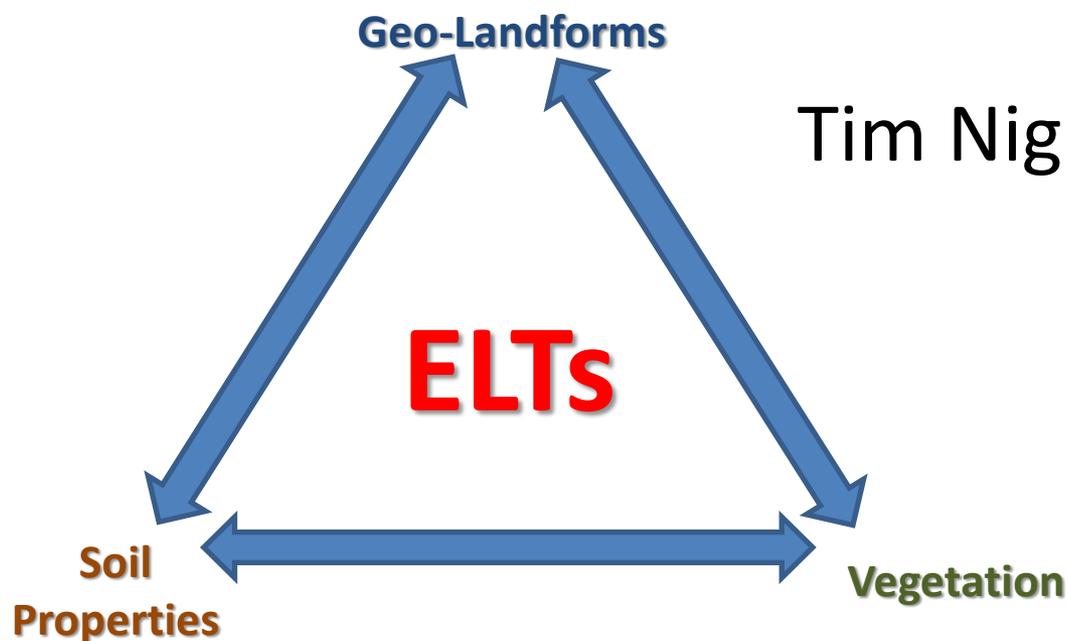
- 2 Urban High Intensity
- 3 Urban Low Intensity
- 4 Barren or Sparsely Vegetated
- 5 Cropland
- 6 Grassland
- 7 Deciduous Forest
- 8 Evergreen Forest
- 9 Mixed Forest
- 10 Deciduous Woody-herbaceous
- 11 Evergreen Woody-herbaceous
- 13 Woody-dominated Wetland
- 14 Herbaceous-dominated Wetland
- 15 Open Water





ECS Project (MO)

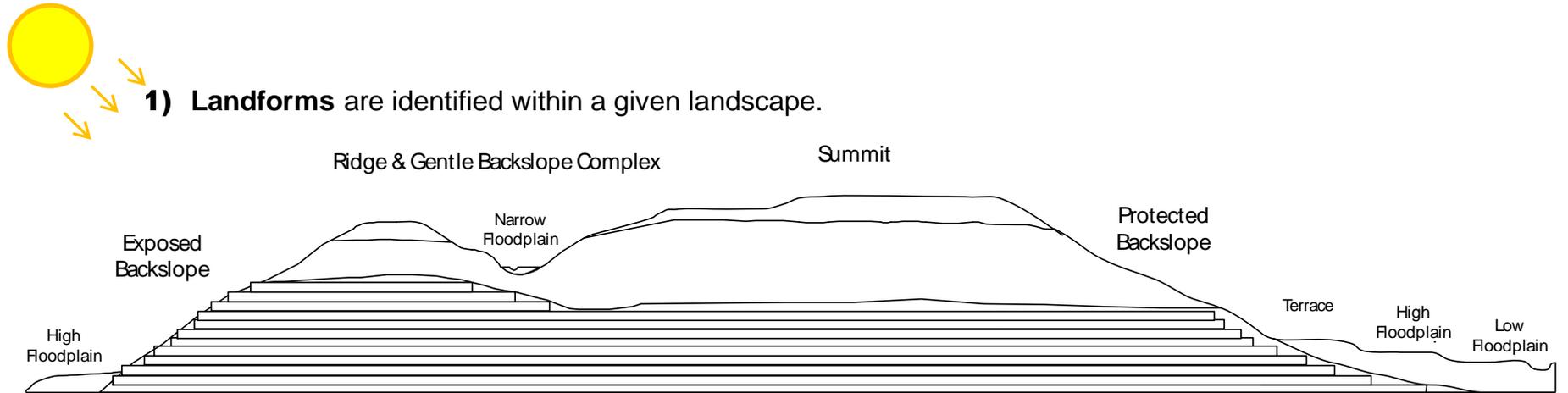
Developing Statewide Ecological Land Types (ELTs) and Ecological Site Descriptions (ESDs)



Tim Nigh and Kyle Steele

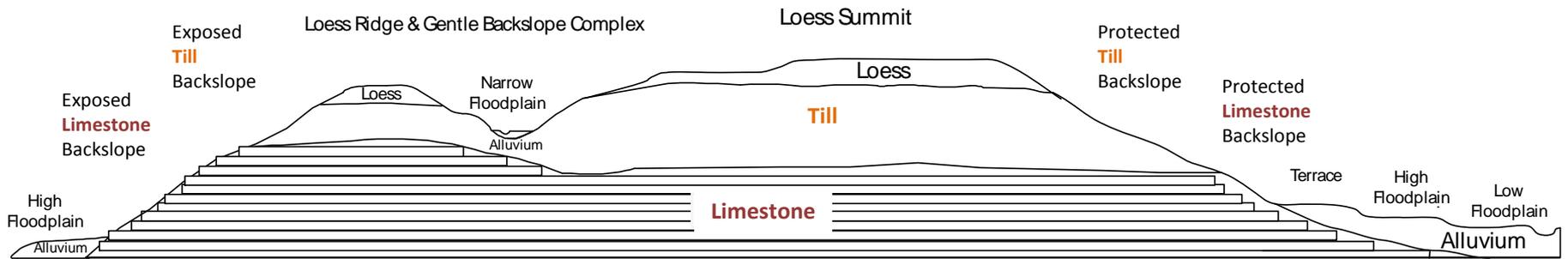


Missouri ELT Development Process



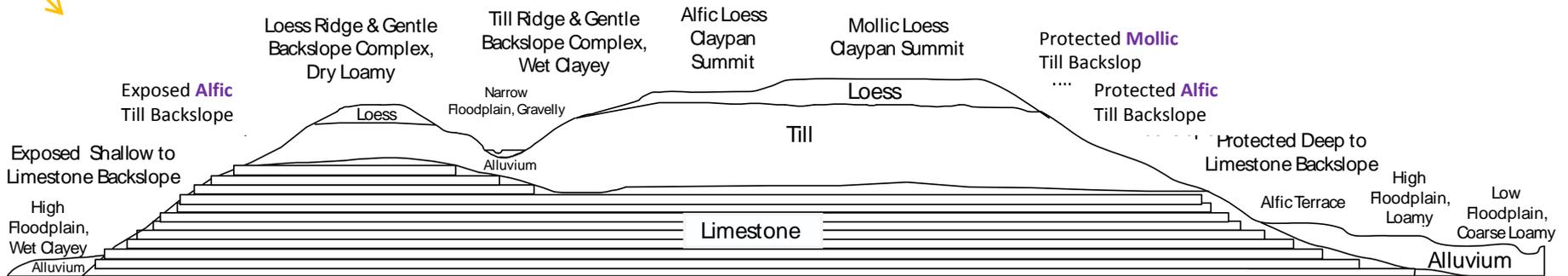
Missouri ELT Development Process

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



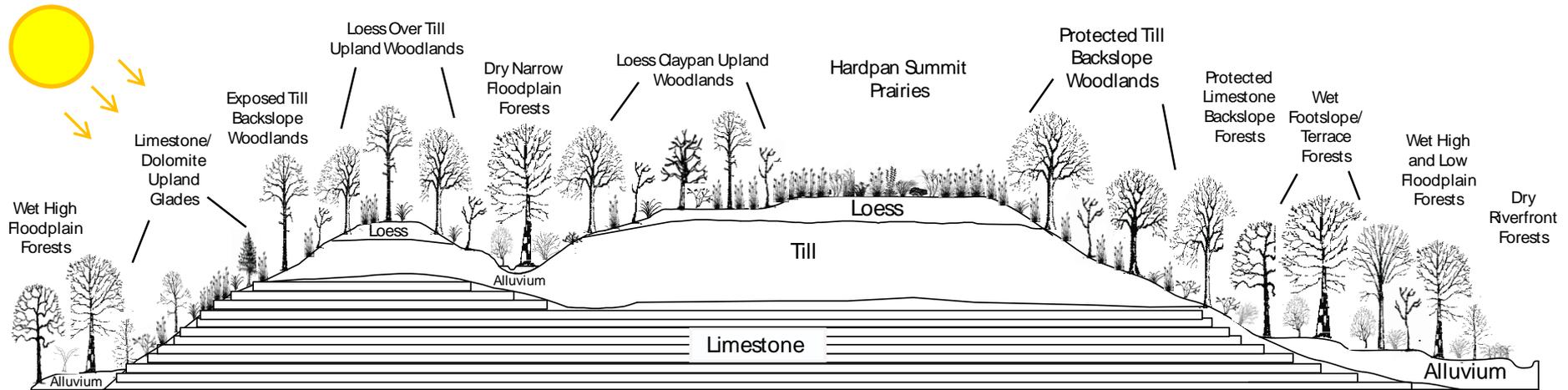
Missouri ELT Development Process

 **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**.

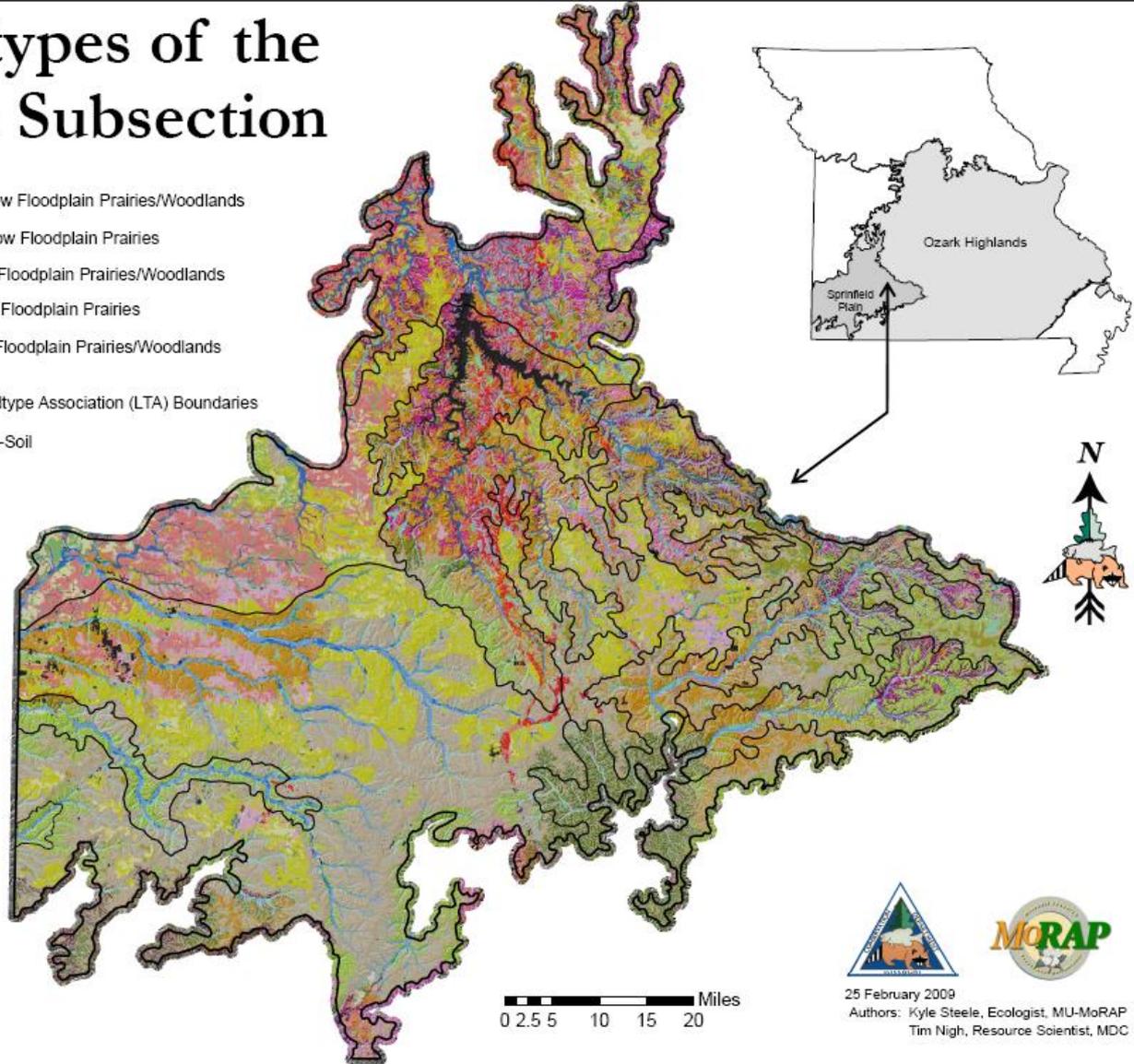


Example for the Springfield Plain

Ecological Landtypes of the Springfield Plain Subsection

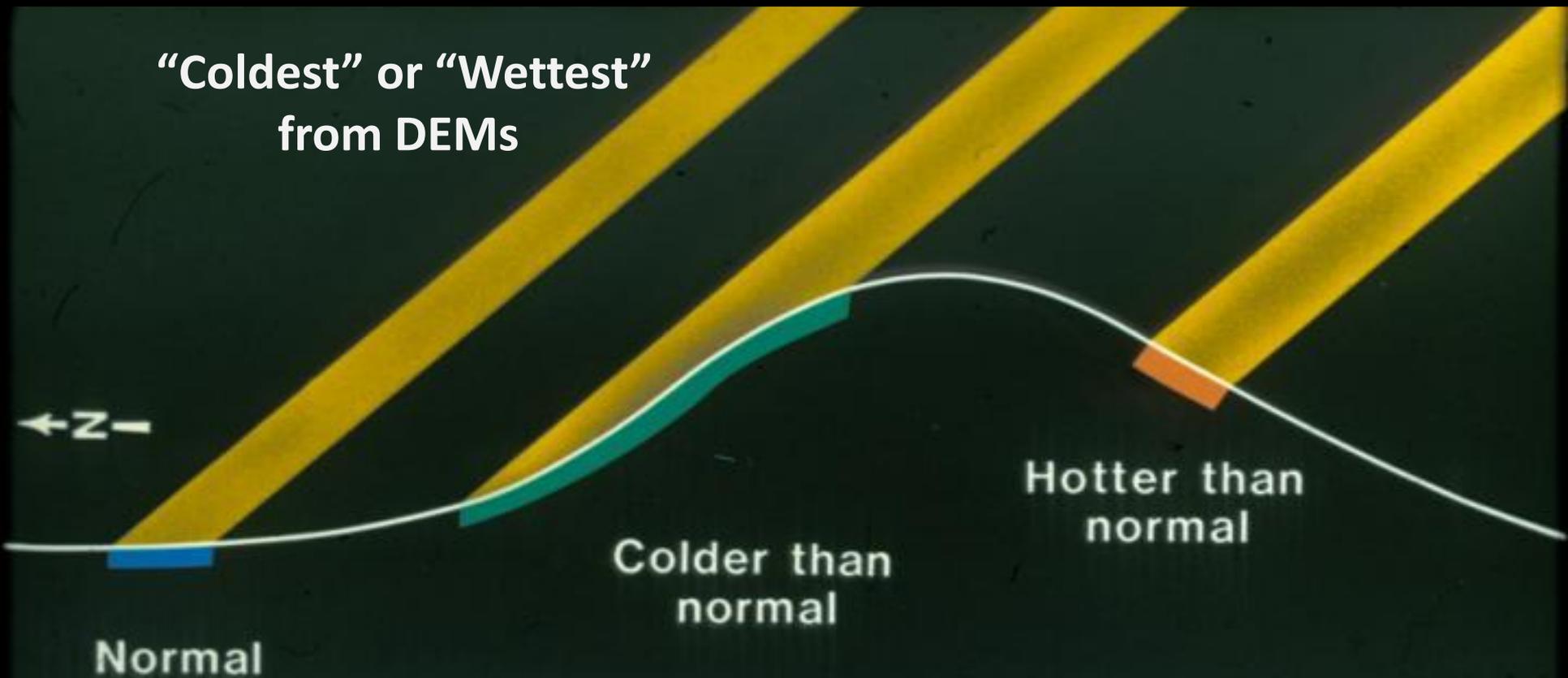
-  Hardpan Summit Prairies
-  Upland Flatwoods
-  Chert Upland Prairies
-  Dry Upland Oak Woodlands
-  Dry-Mesic Upland Oak Woodlands
-  Ultic Chert Backslope Woodlands
-  Alfic Chert Backslope Woodlands
-  Limestone/Dolomite Upland Prairies
-  Limestone/Dolomite Upland Glades
-  Limestone/Dolomite Backslope Glades
-  Limestone/Dolomite Upland Woodlands
-  Limestone/Dolomite Backslope Woodlands
-  Sandstone/Shale Upland Prairies
-  Sandstone Upland Glades
-  Sandstone Upland Woodlands
-  Shale Upland Woodlands
-  Shale Backslope Woodlands
-  Dry Foothlope and Terrace Prairies
-  Wet Foothlope and Terrace Prairies
-  Dry Foothlope and Terrace Woodlands
-  Wet Foothlope and Terrace Woodlands
-  Dry Sinkhole
-  Wet Sinkhole

-  Dry Narrow Floodplain Prairies/Woodlands
-  Wet Narrow Floodplain Prairies
-  Dry High Floodplain Prairies/Woodlands
-  Wet High Floodplain Prairies
-  Dry Low Floodplain Prairies/Woodlands
-  Landtype Association (LTA) Boundaries
-  Non-Soil



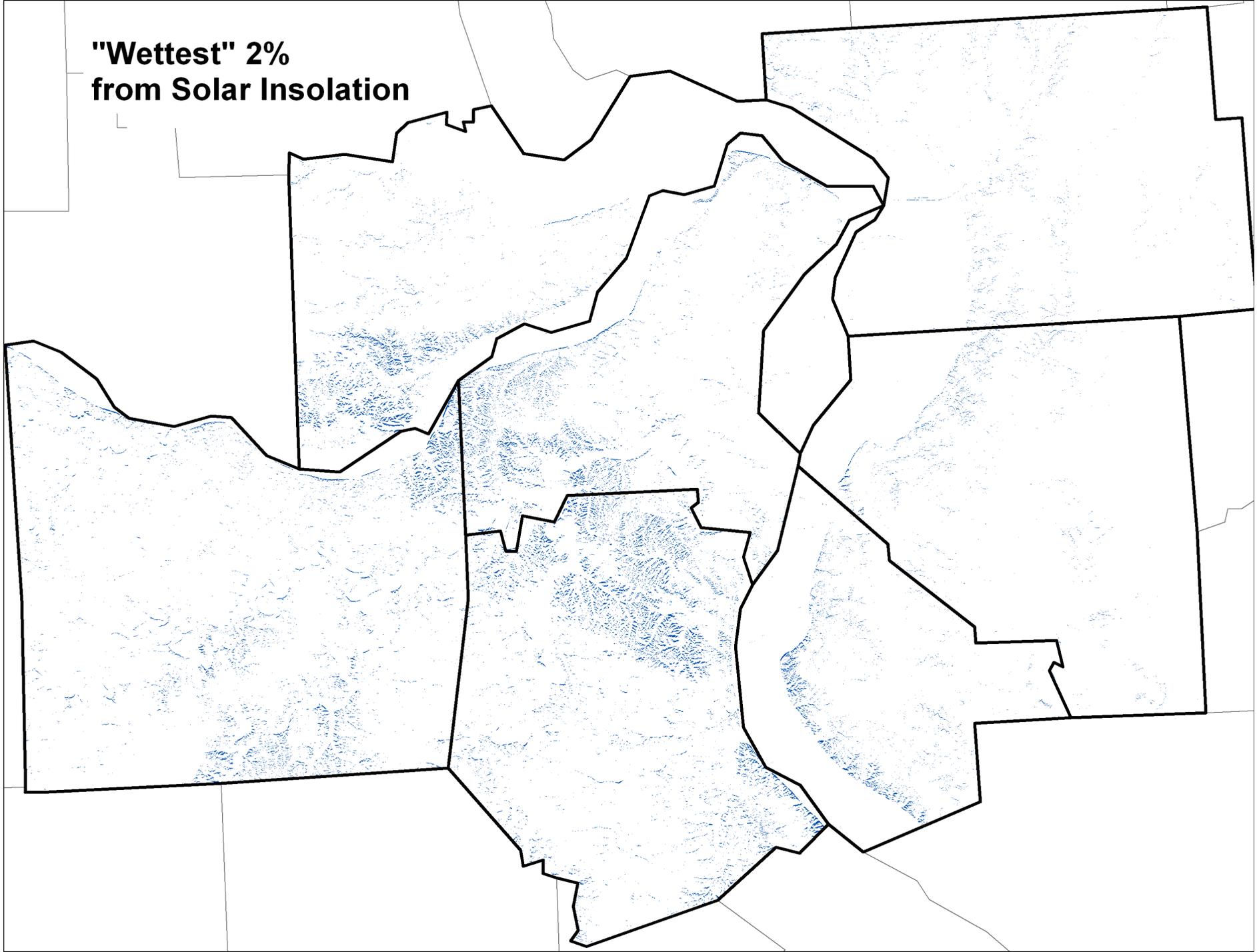
25 February 2009
 Authors: Kyle Steele, Ecologist, MU-MoRAP
 Tim Nigh, Resource Scientist, MDC

"Coldest" or "Wettest" from DEMs

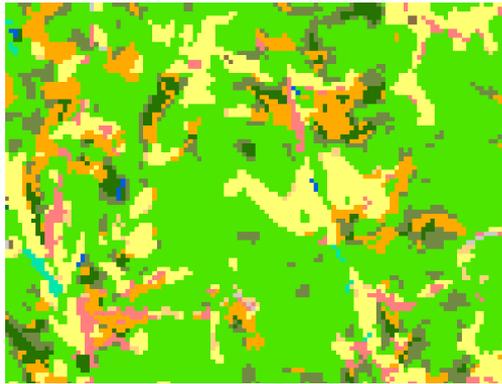


From Bailey (1996)

**"Wettest" 2%
from Solar Insolation**



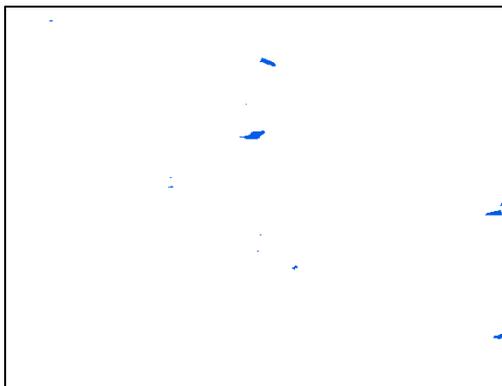
Land Cover and Ancillary Data Applied to Image Objects to Map 60 Current Vegetation Types



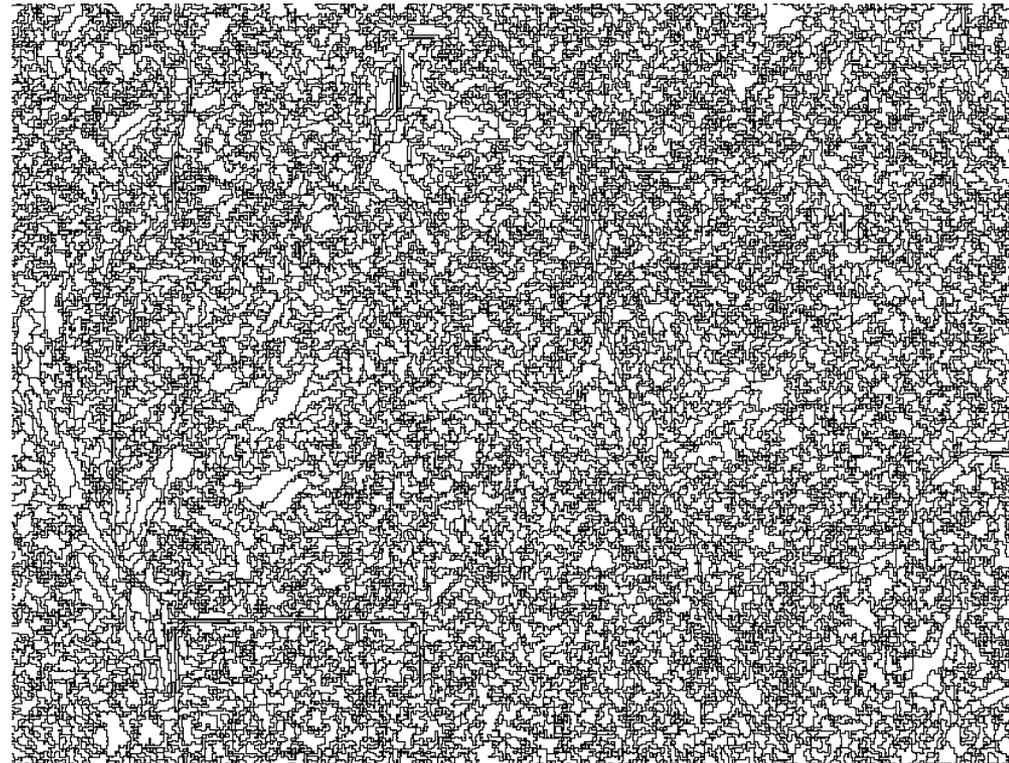
Land Cover



ELT's



"Wettest"
Areas



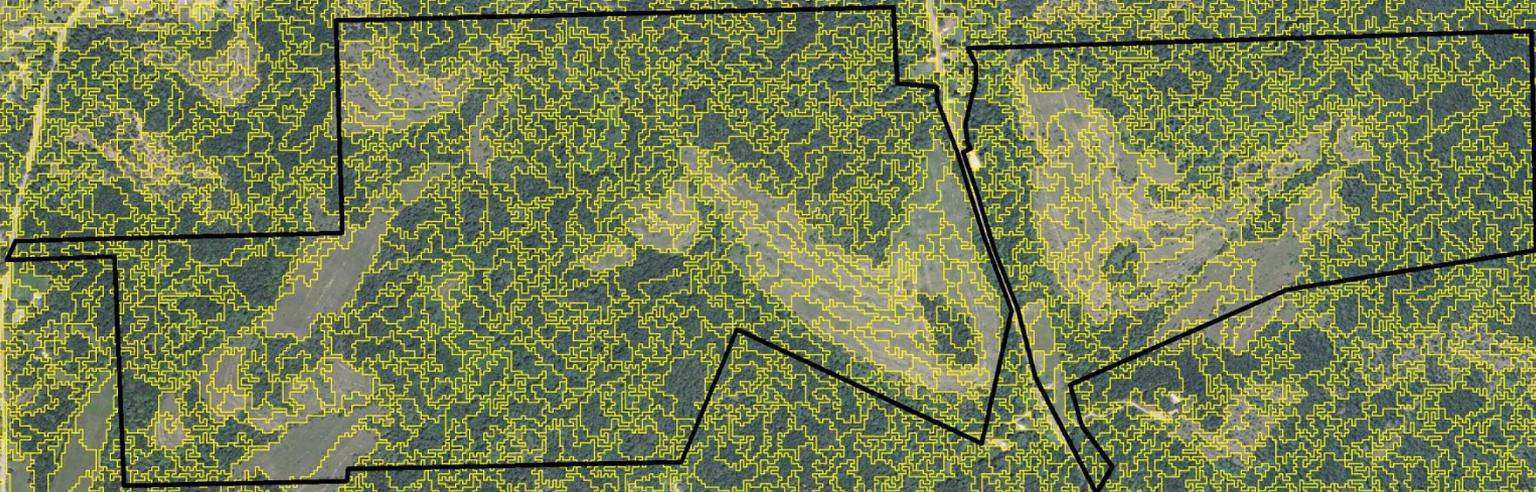


Victoria Glades

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



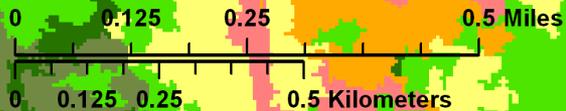
30 meter Land Cover from Satellite Imagery

Victoria Glades



Land Cover from Satellite Image Analysis Applied to Objects

Victoria Glades



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

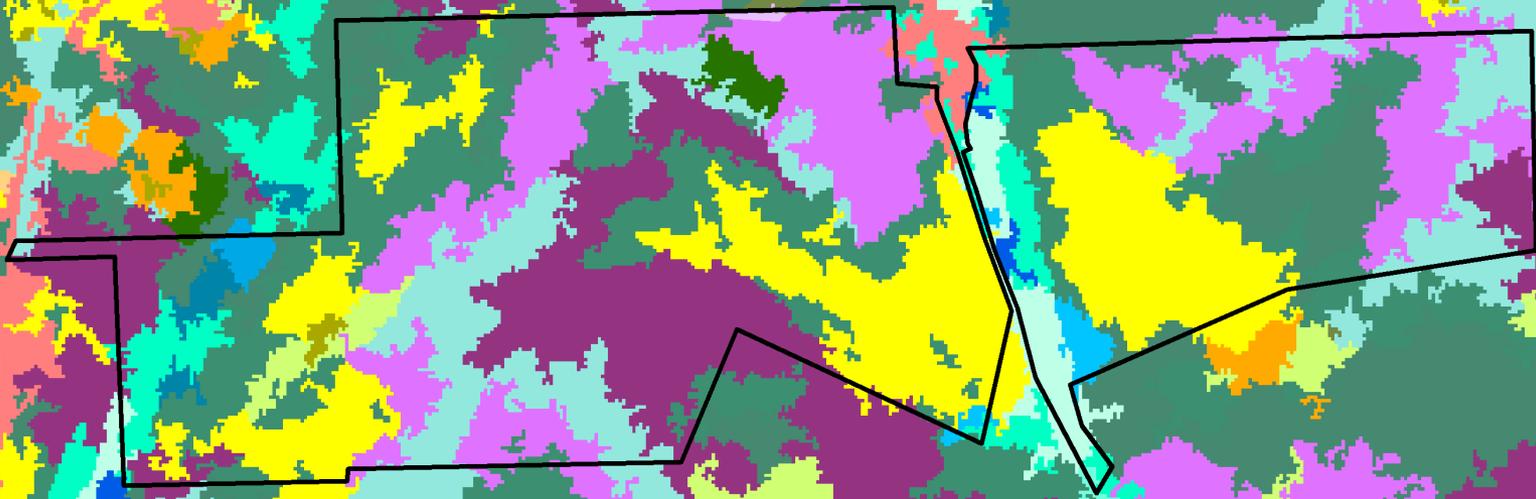
Bottomland: Buttonbush/Black Willow-Water Locust Woody Wetland

Woody-dominated Wetland (non-riverine)

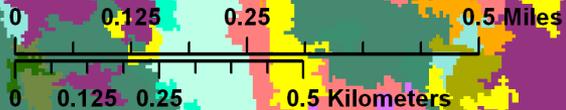
15 Open Water

Current Vegetation Classes for Victoria Glades Area

Current Vegetation from ELT's together with Current Land Cover

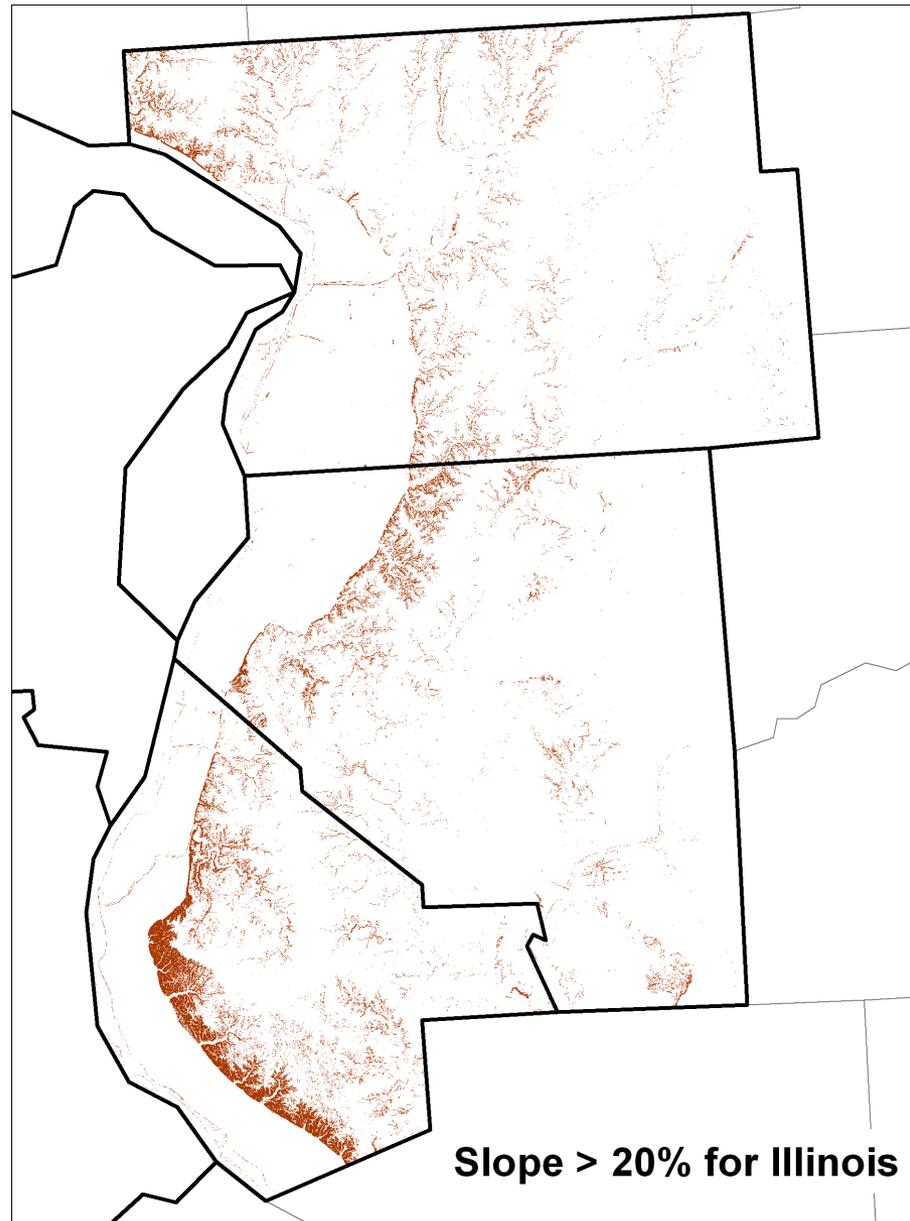


Victoria Glades



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

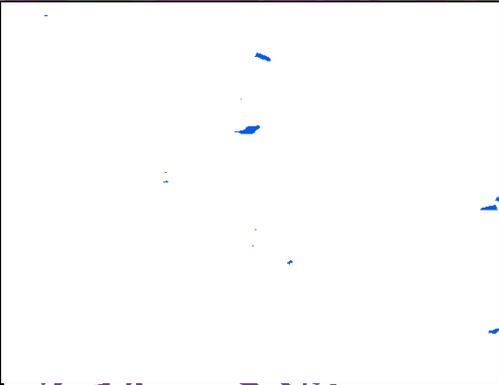
Land Cover



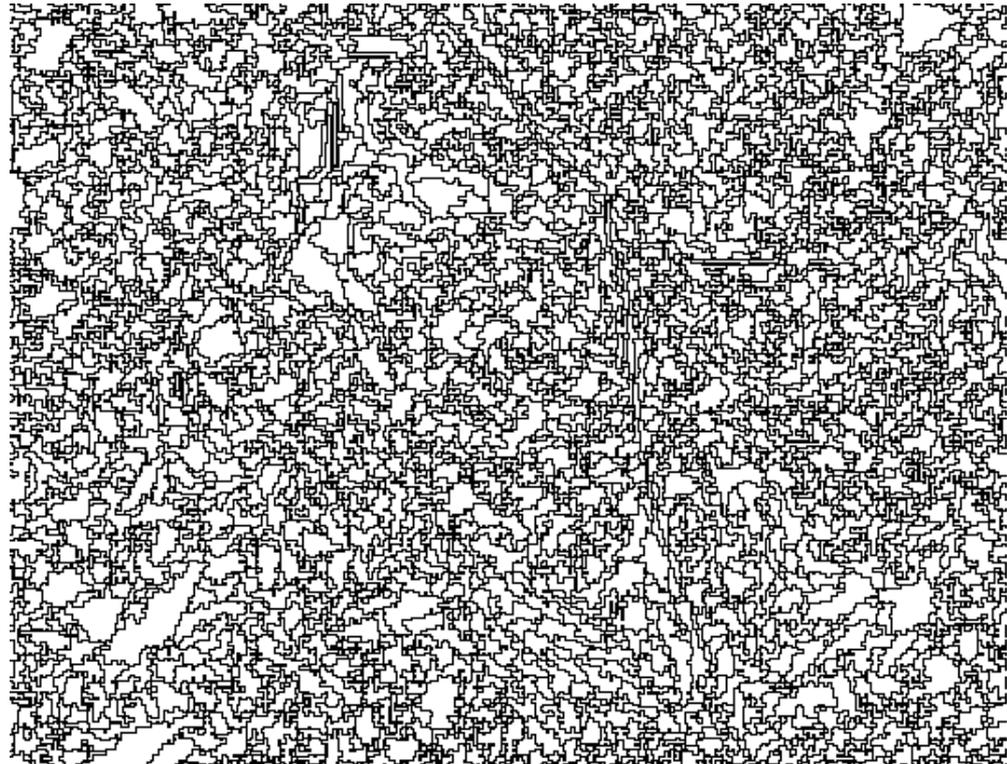
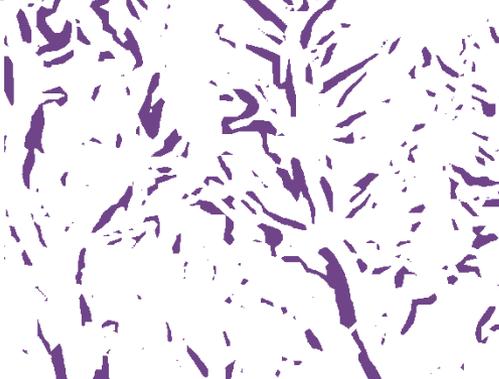
Soils



“Wettest”
Areas

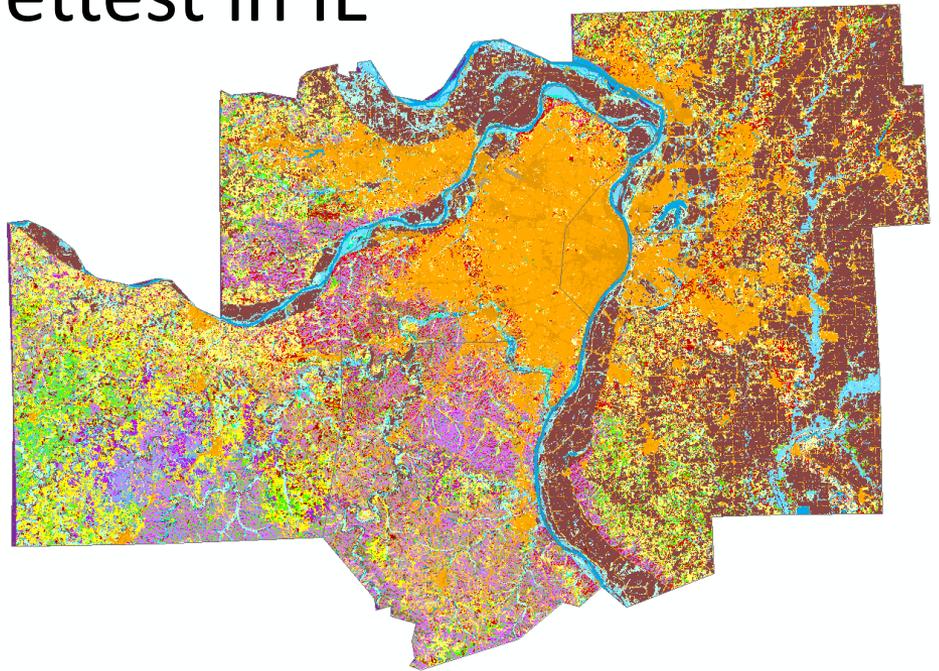


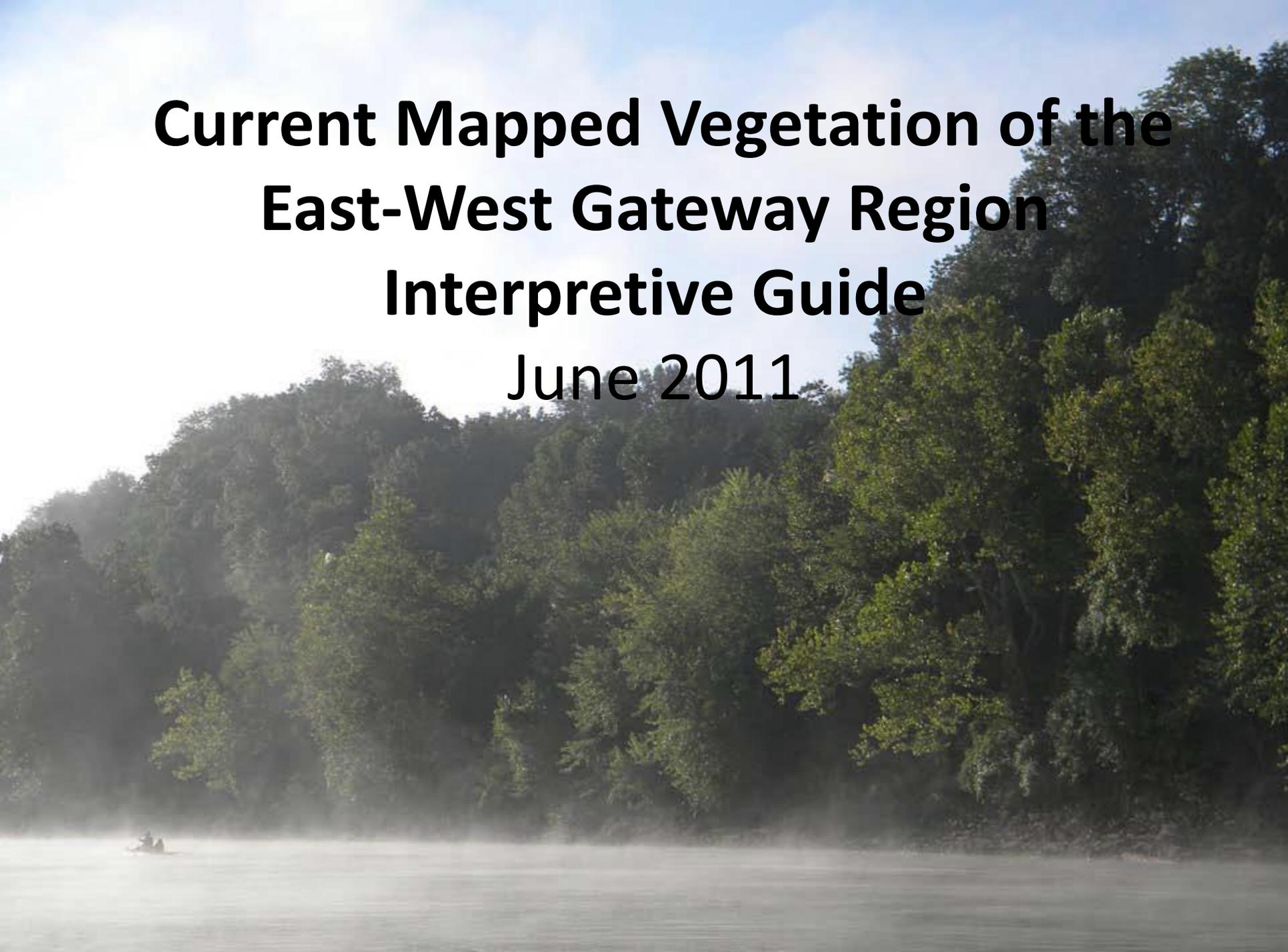
Steep
Slopes



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

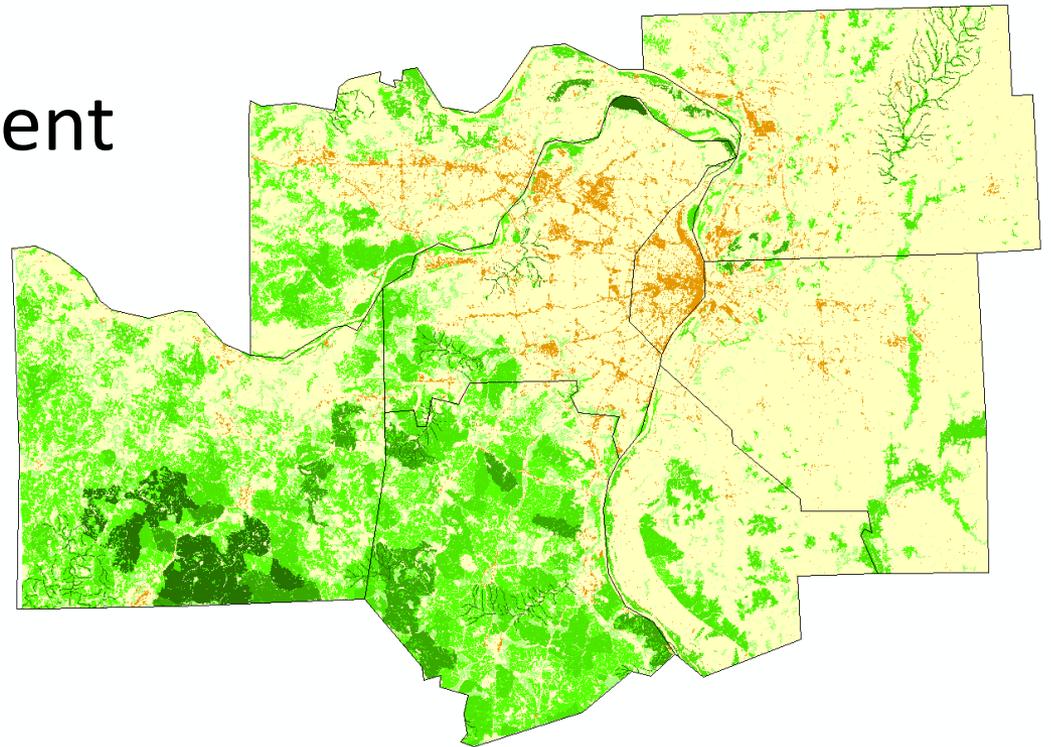




**Current Mapped Vegetation of the
East-West Gateway Region
Interpretive Guide
June 2011**

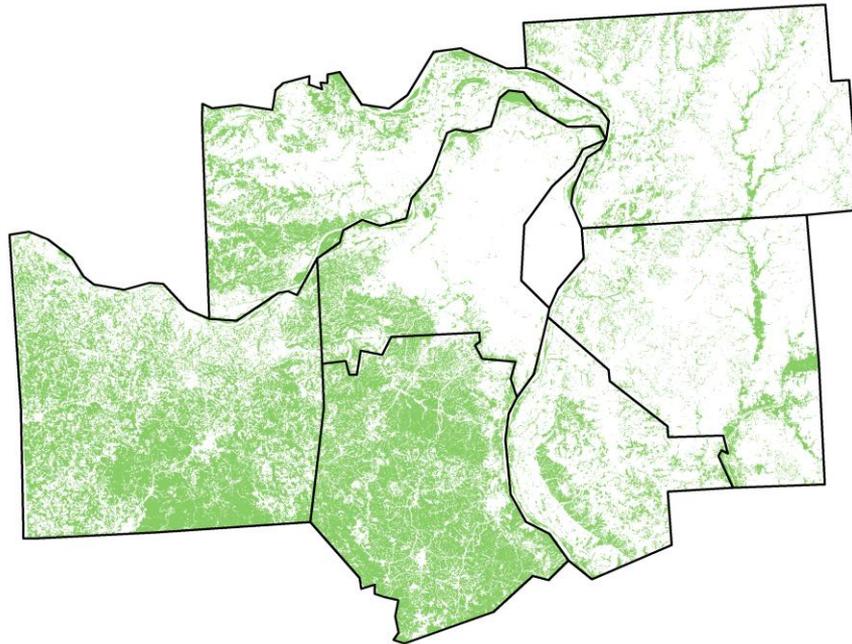
2. Regional Ecological Significance Modeling

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

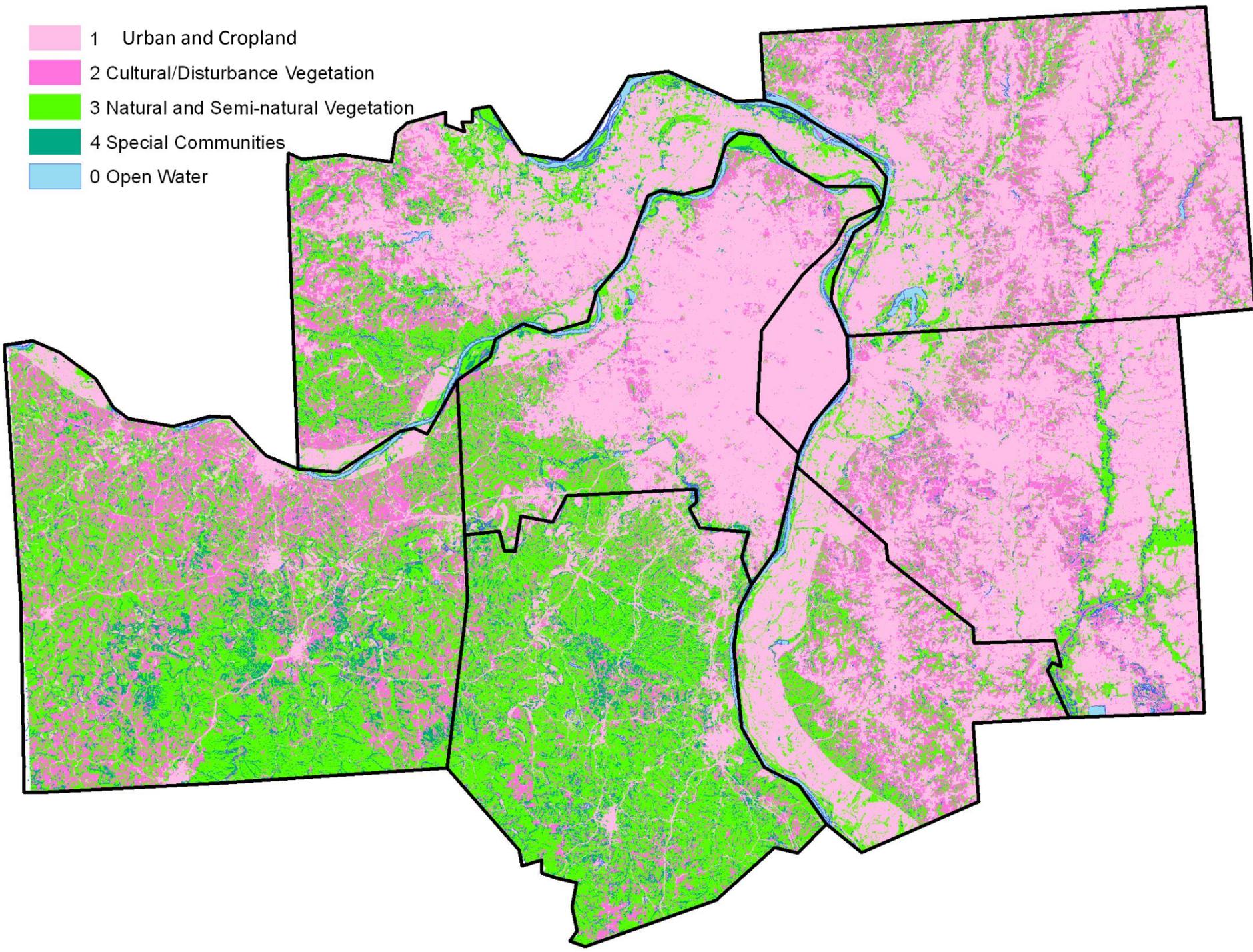


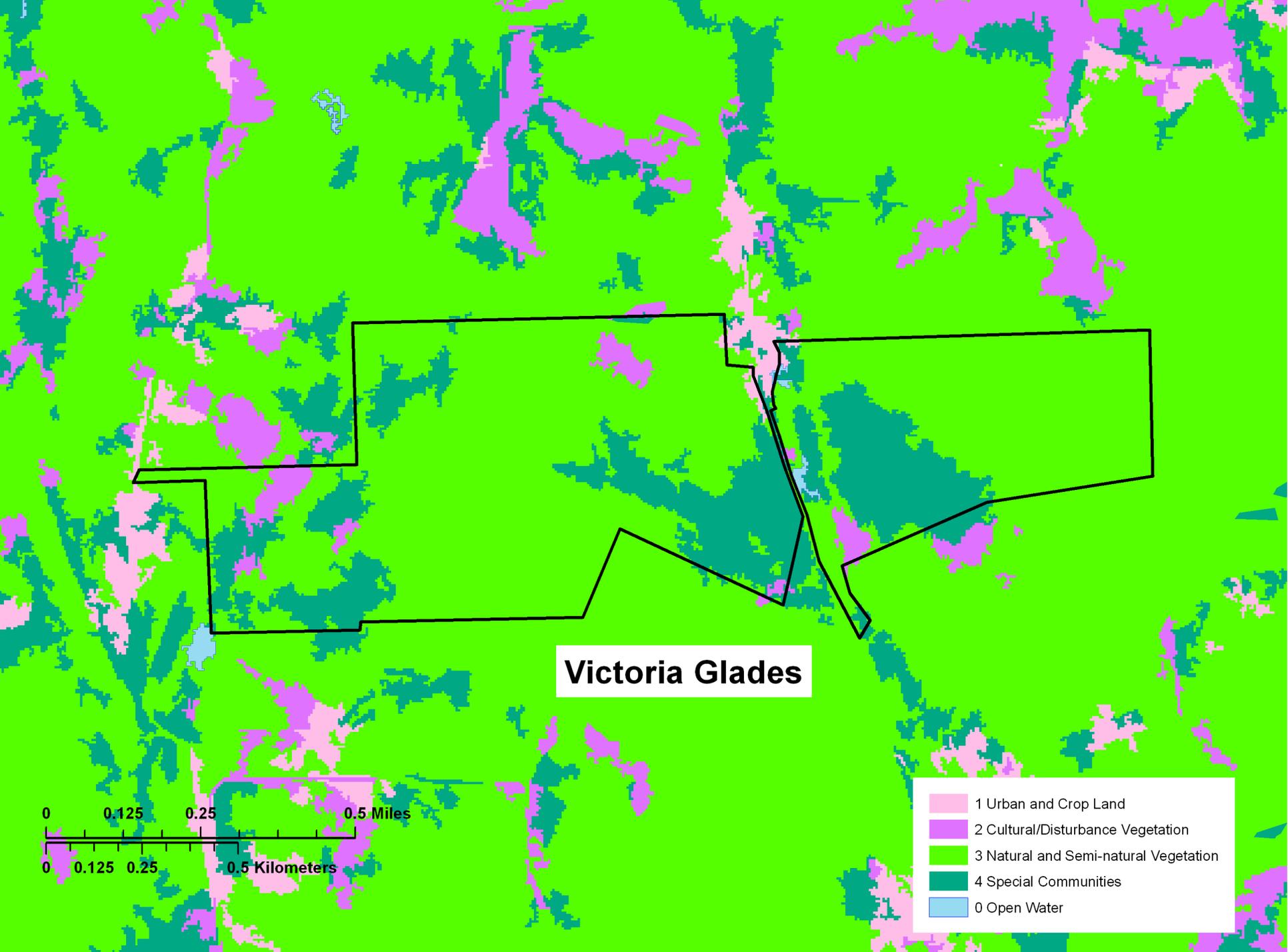
Development of Patches

- 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

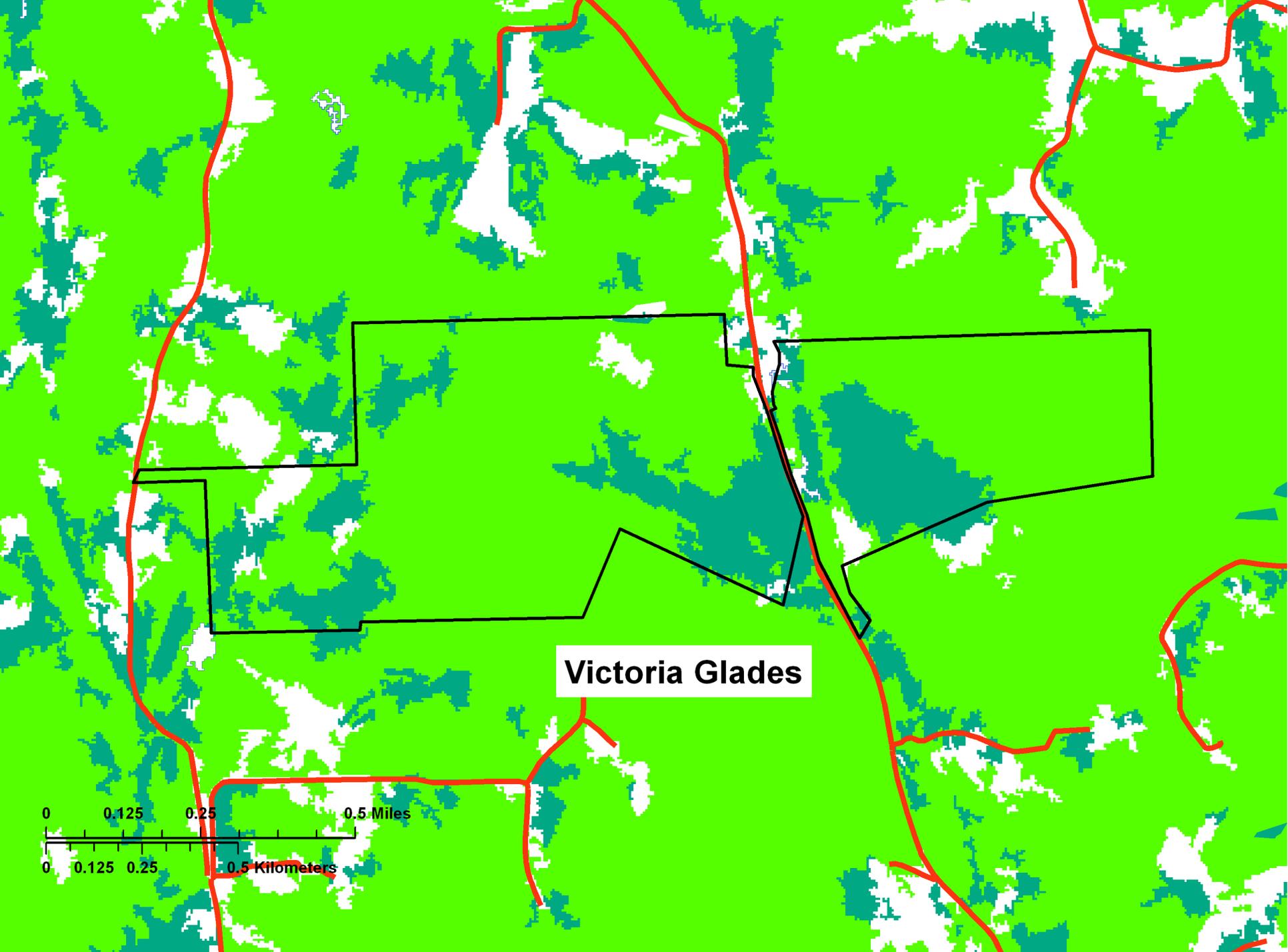




Victoria Glades

0 0.125 0.25 0.5 Miles
0 0.125 0.25 0.5 Kilometers

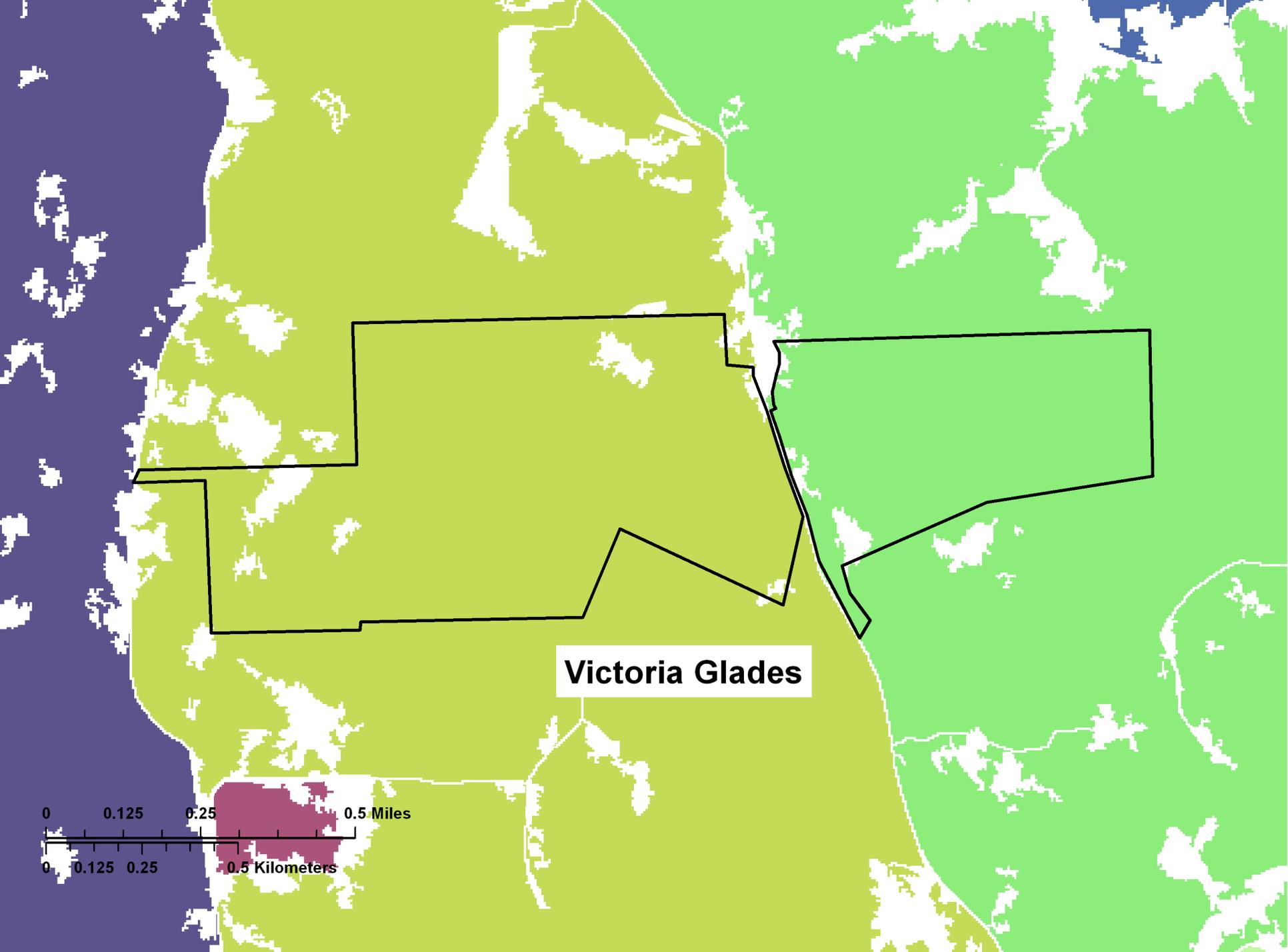
- 1 Urban and Crop Land
- 2 Cultural/Disturbance Vegetation
- 3 Natural and Semi-natural Vegetation
- 4 Special Communities
- 0 Open Water



Victoria Glades

0 0.125 0.25 0.5 Miles

0 0.125 0.25 0.5 Kilometers



Victoria Glades



Ecological Significance Ranking: Conceptual Underpinning

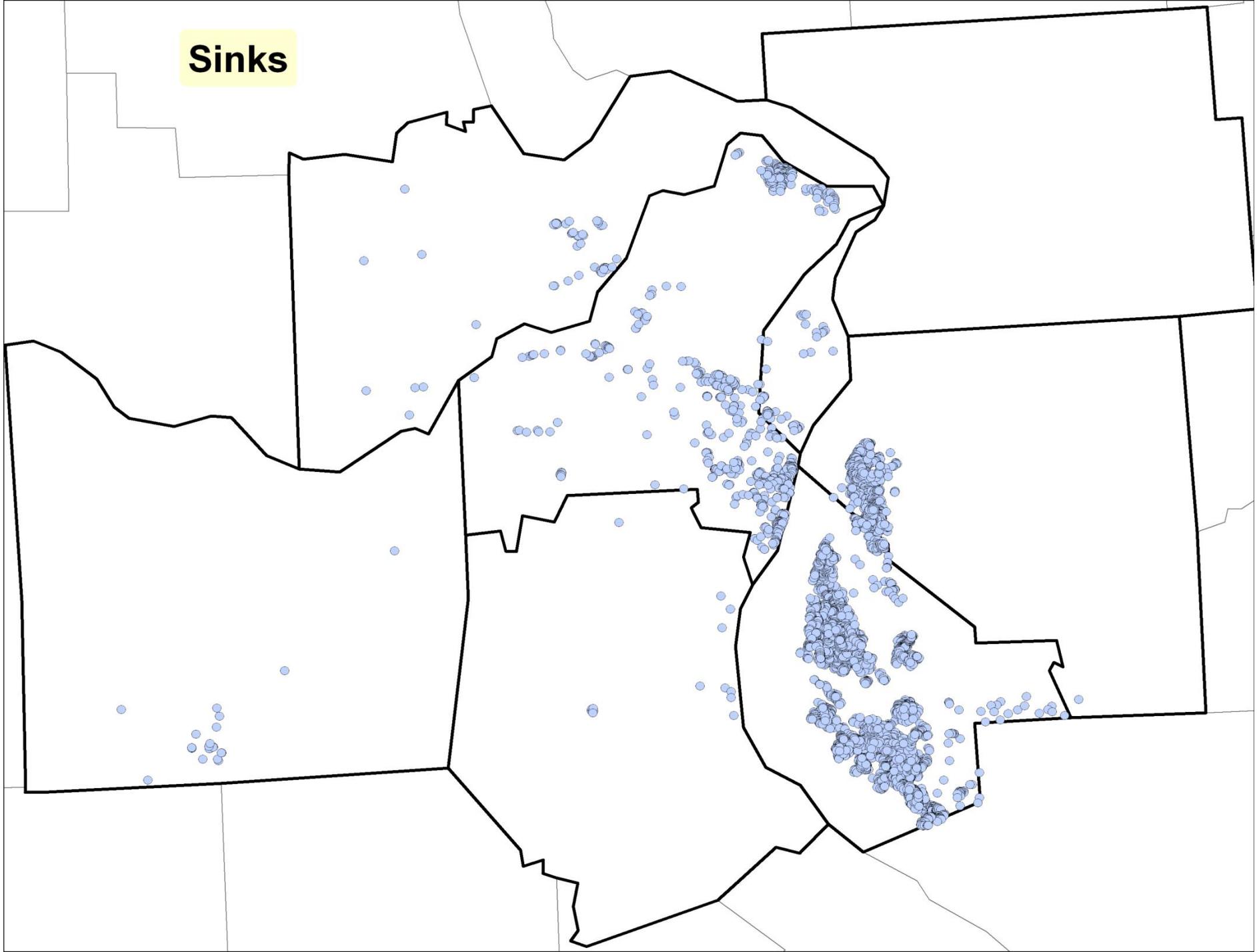
- Coarse filter / fine filter
 - Coarse filter conservation targets are communities
 - Fine filter targets are species
- Consider long-term functionality
 - Most species of conservation concern require fairly large patches to maintain viable populations
 - Existing public lands offer the opportunity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

Attribution of Patches

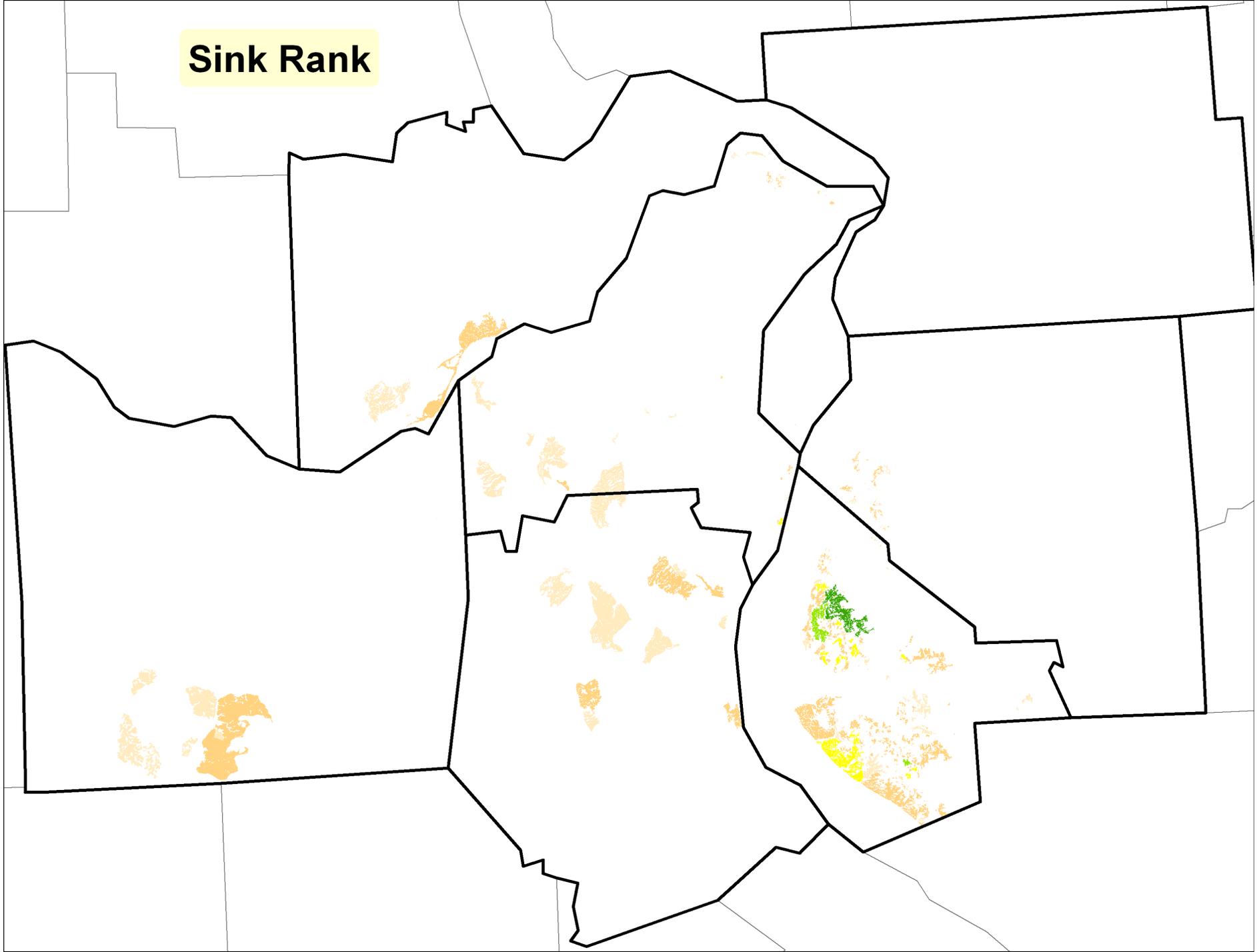
- Size and Shape
- Area of Large Forest Patches
- Area of Significant Communities
- Area of Significant Stream Buffers
- Mapped Globally Rare Species
- Mapped Regionally Significant Species
- Maximum Species Diversity from Models
- Number of Springs
- Number of Karst Sinks
- Area of Public Land

All ranked 1-5

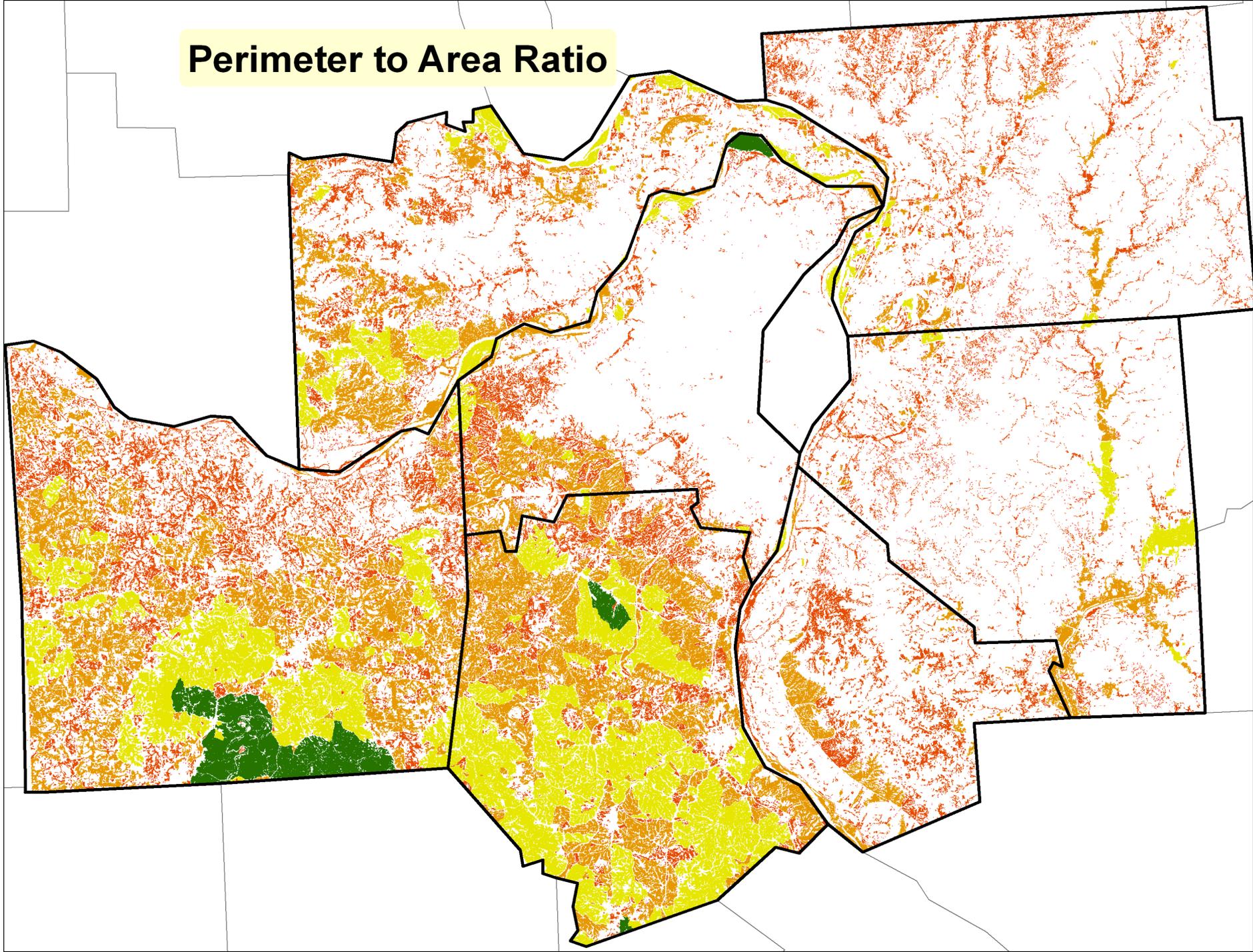
Sinks



Sink Rank



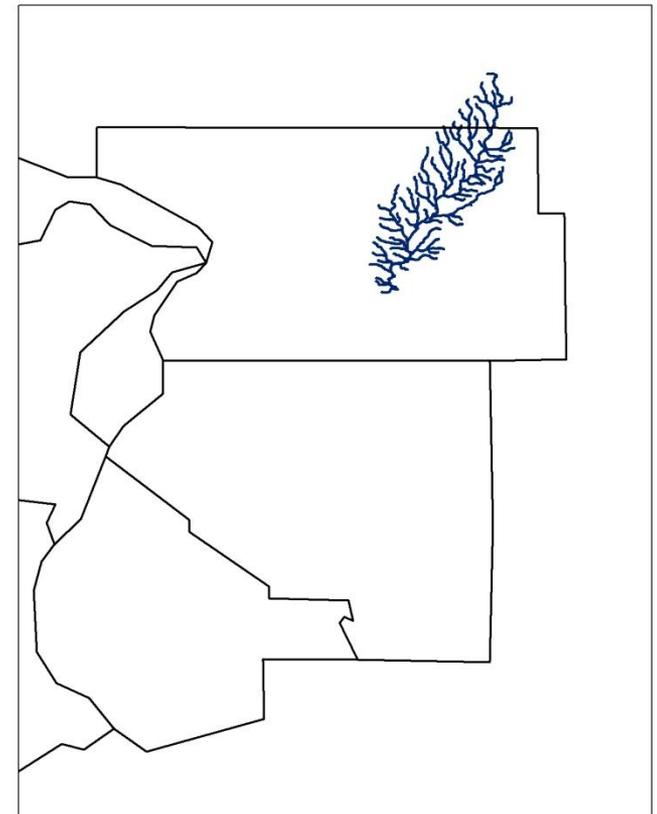
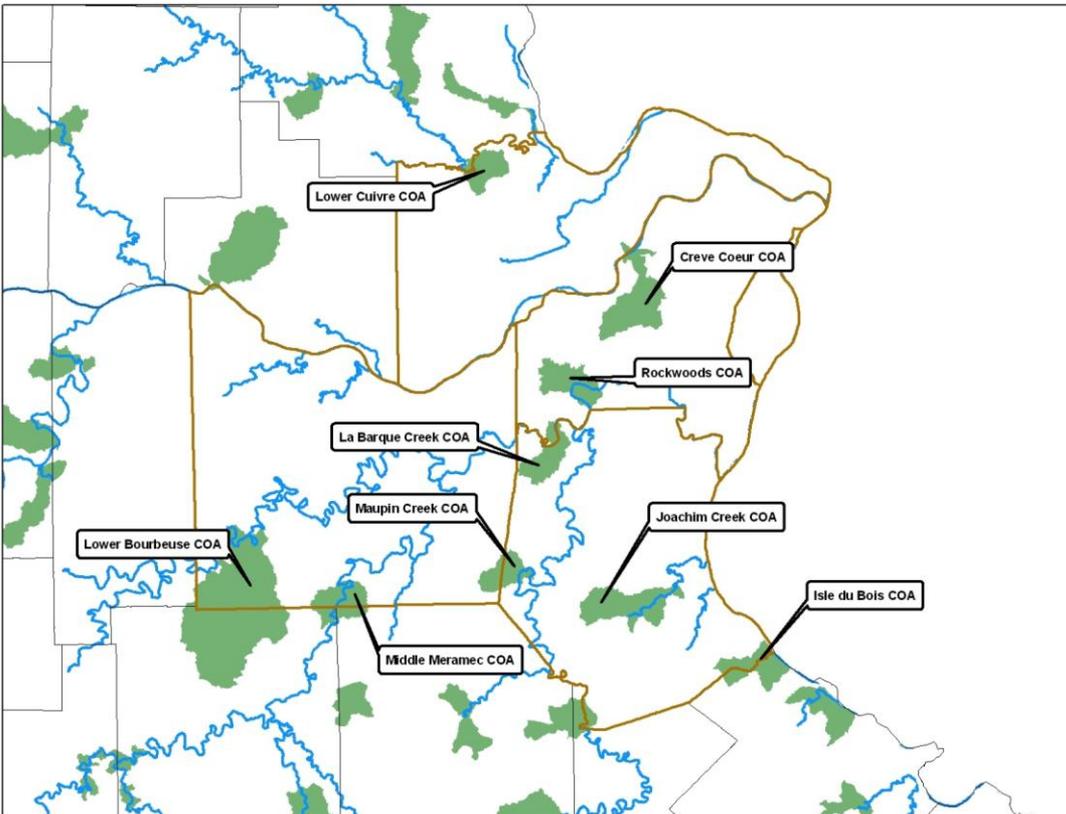
Perimeter to Area Ratio



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

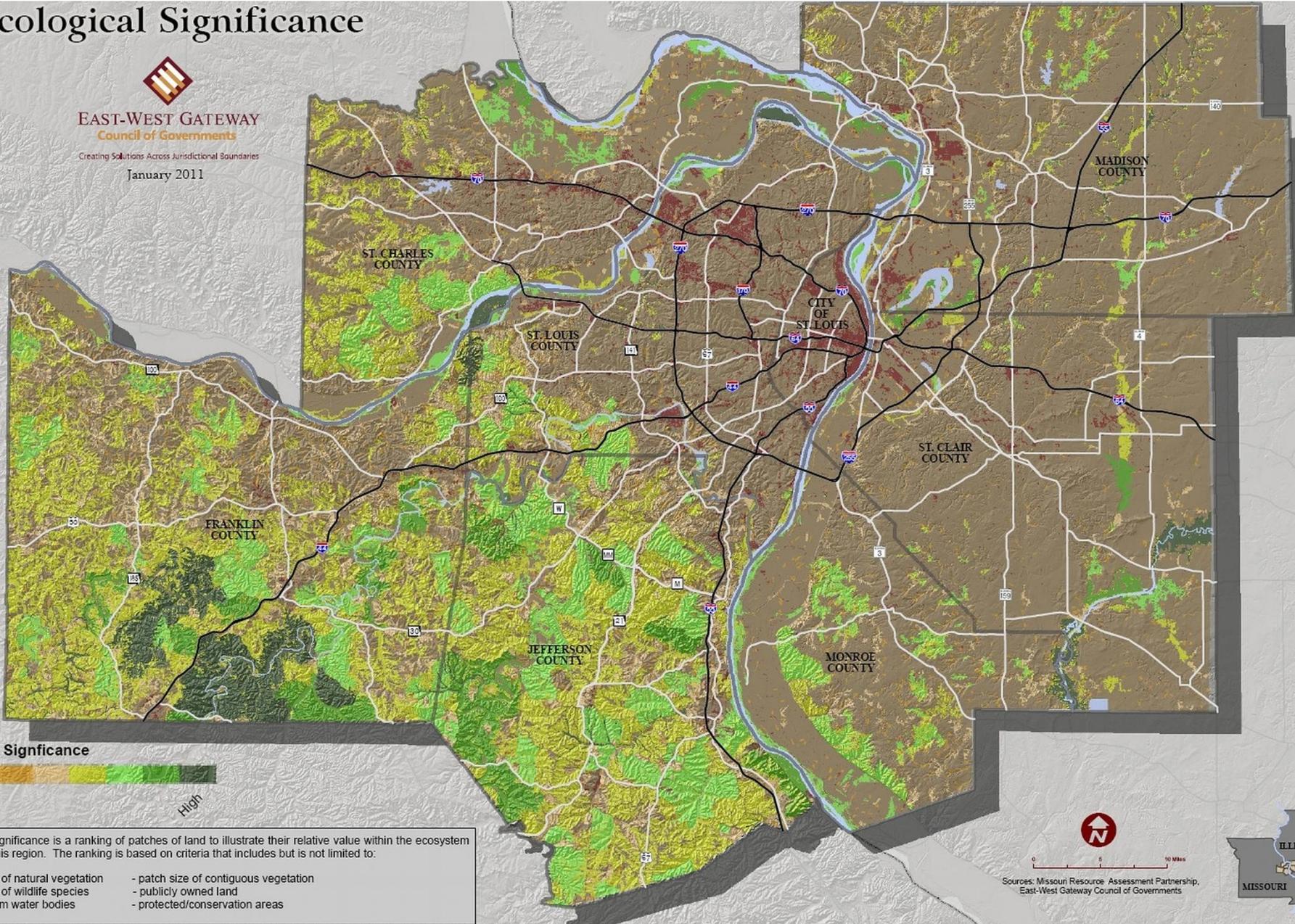
Ecological Significance



EAST-WEST GATEWAY
Council of Governments

Creating Solutions Across Jurisdictional Boundaries

January 2011





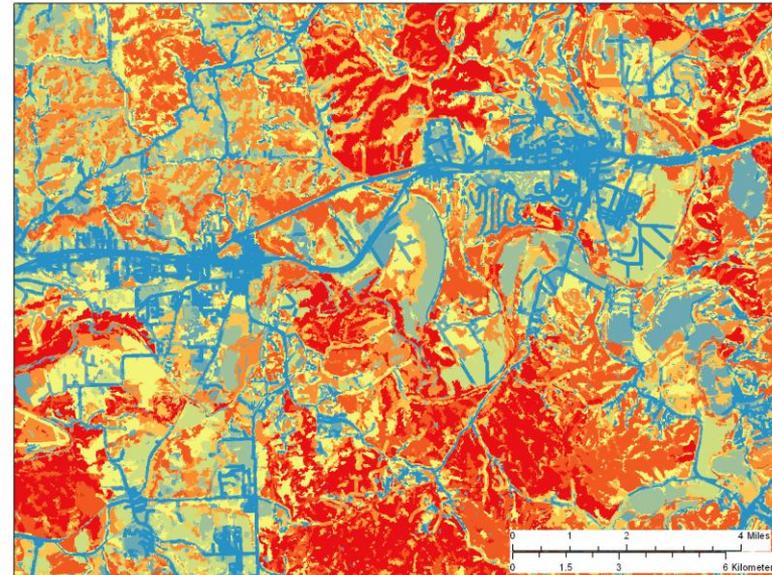
**Ecological Approach to
Infrastructure Development
For the East-West Gateway
Final Report for FY2011**

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

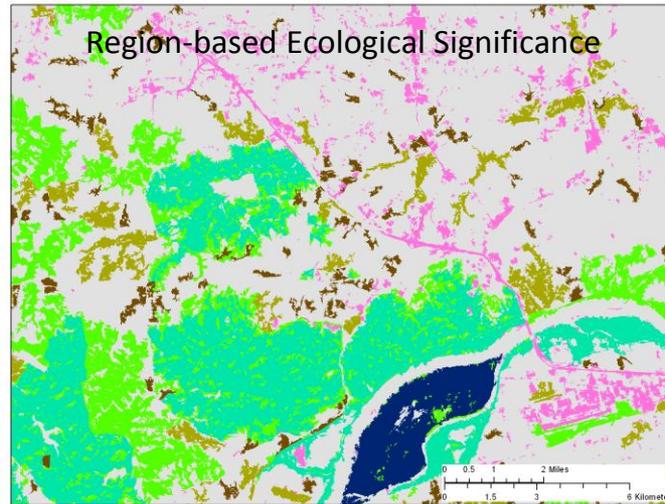
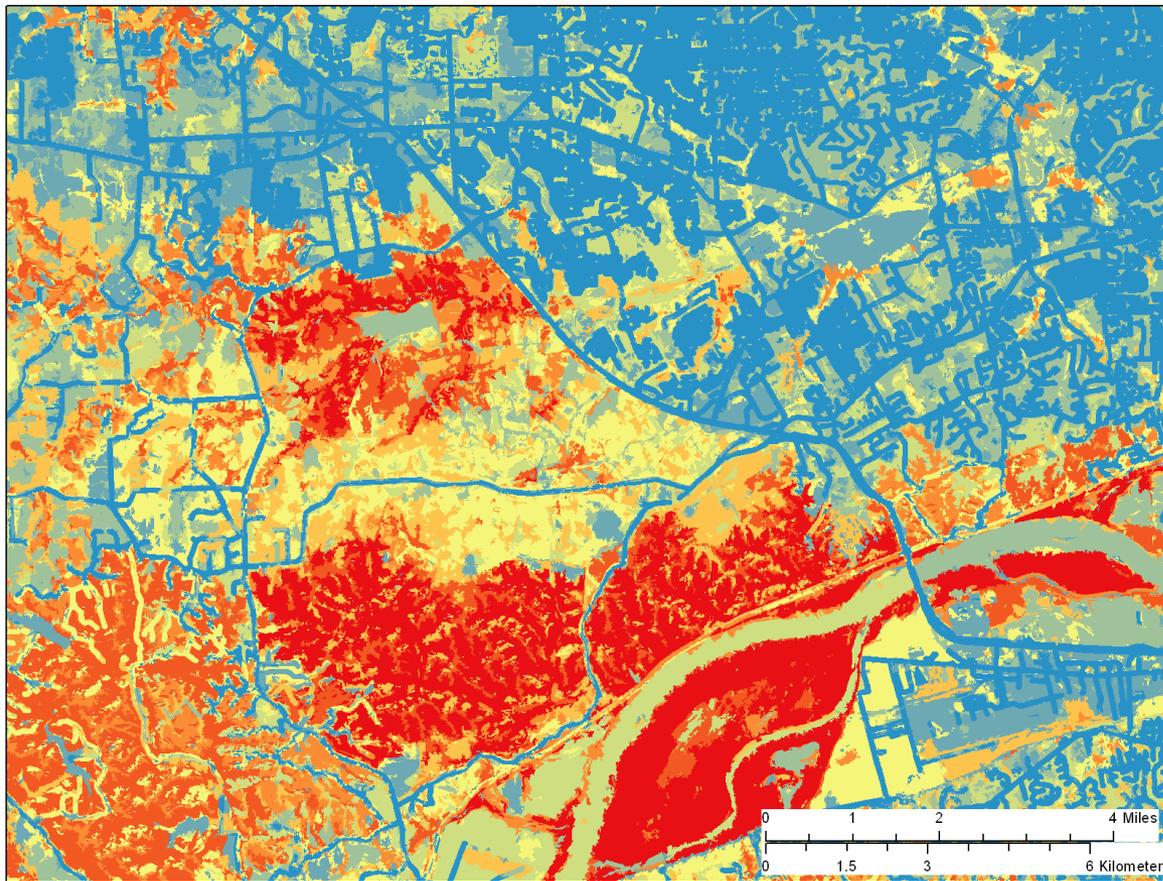
- Community Importance
- Regional Significance
- Federal Rare Species
- Element Occurrence Record
- Public Lands
- Roads



LaBarque Creek Conservation Area

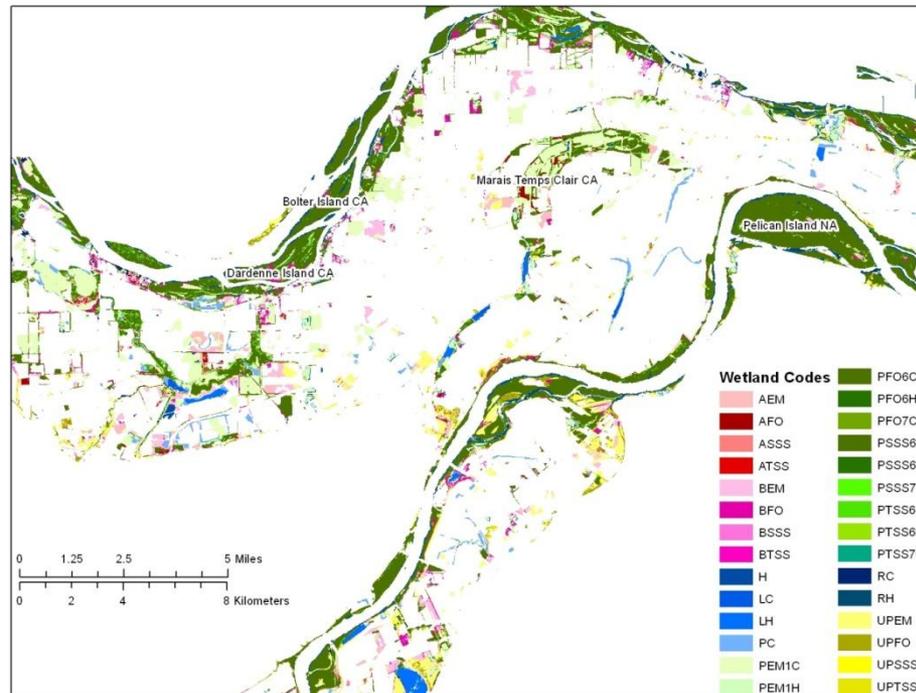
Project-based Ecological Significance

August A. Busch Wildlife Area



4. New Work

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

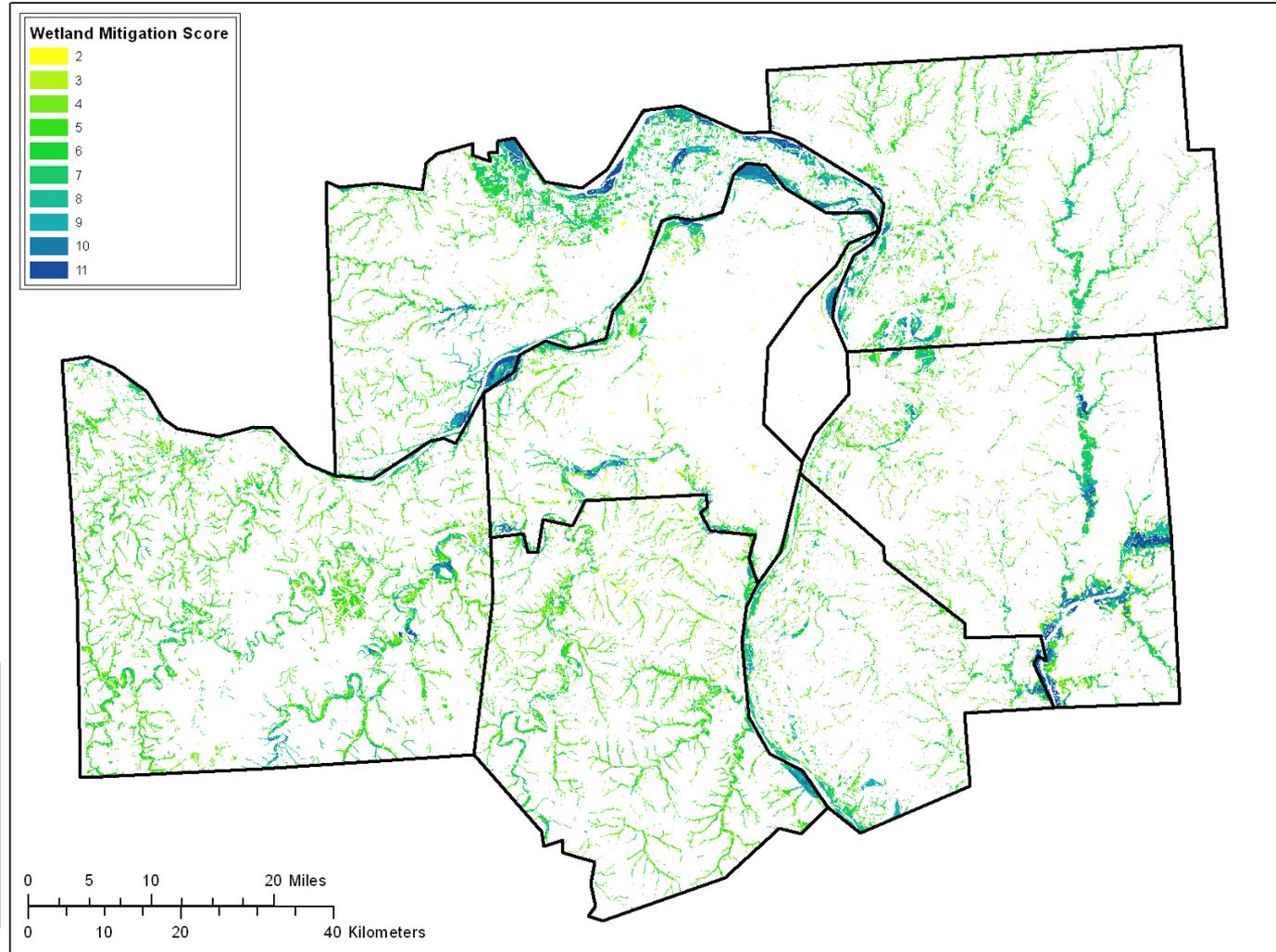


Wetland Mitigation versus Wetland Restoration

- 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.

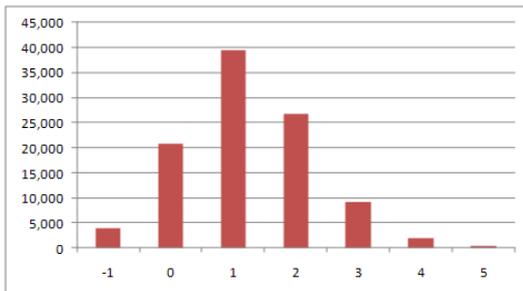
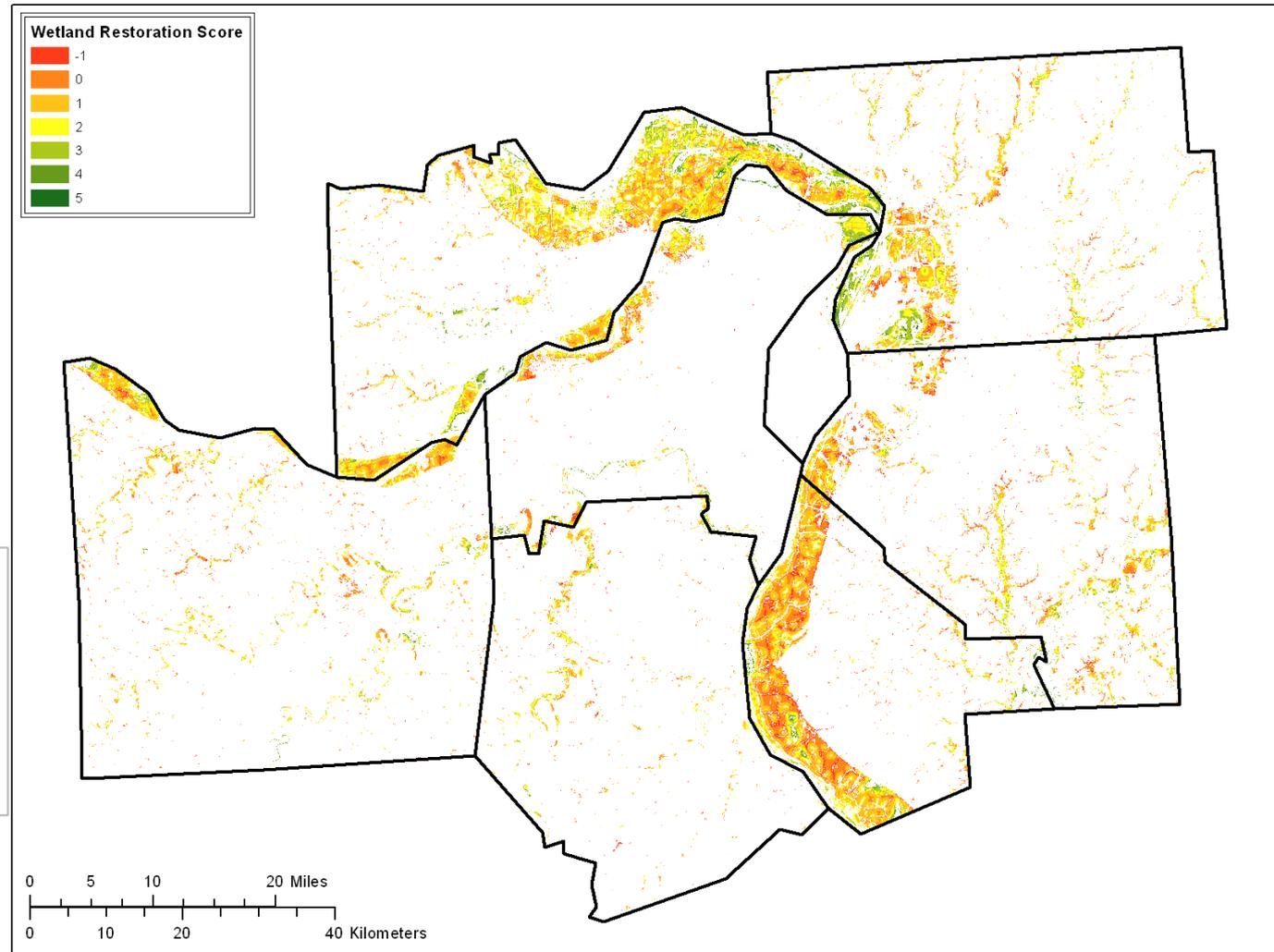
Previous Wetland Mitigation Model

- 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

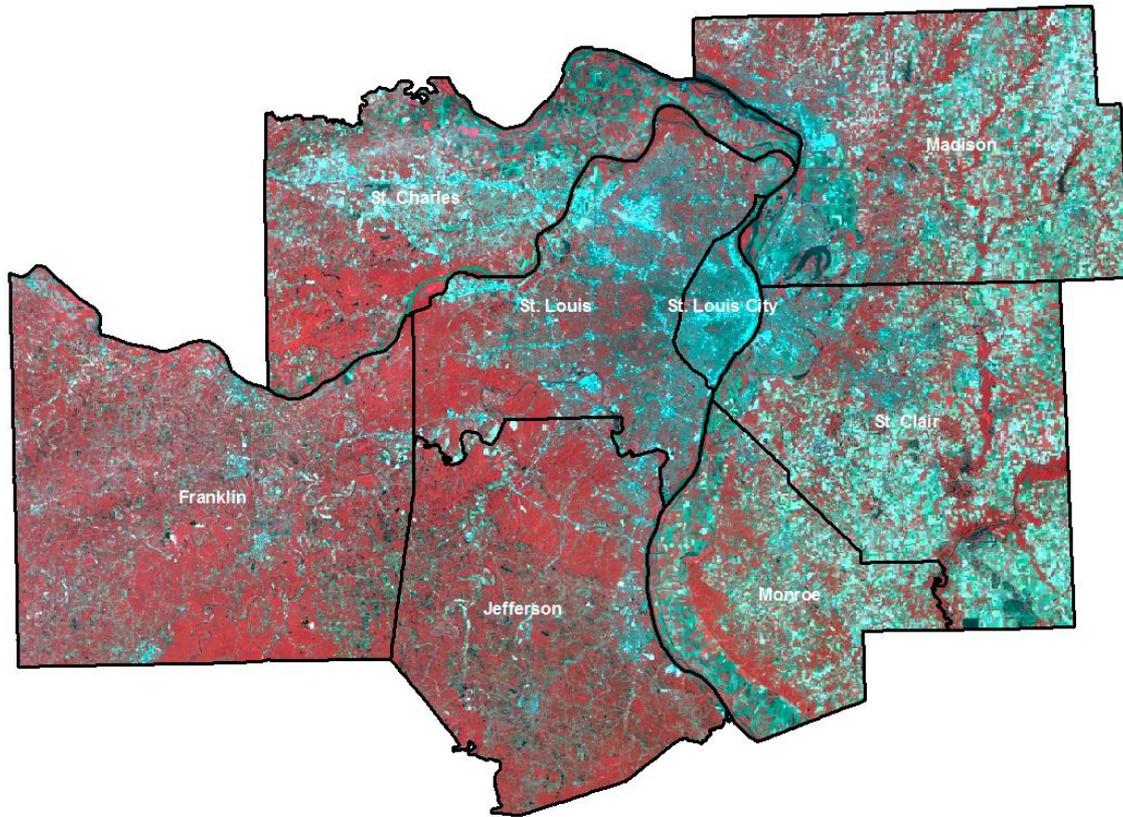


LULC Change

- 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

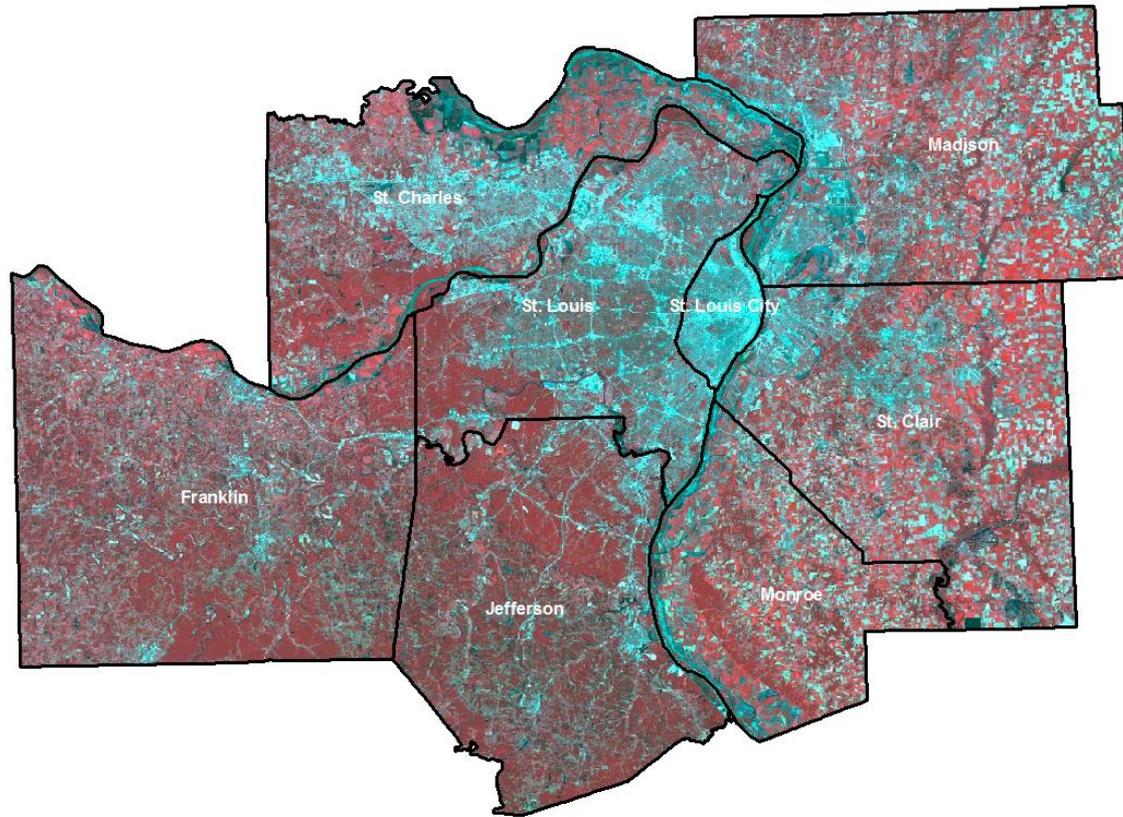
LULC Change

2008 Landsat Imagery



LULC Change

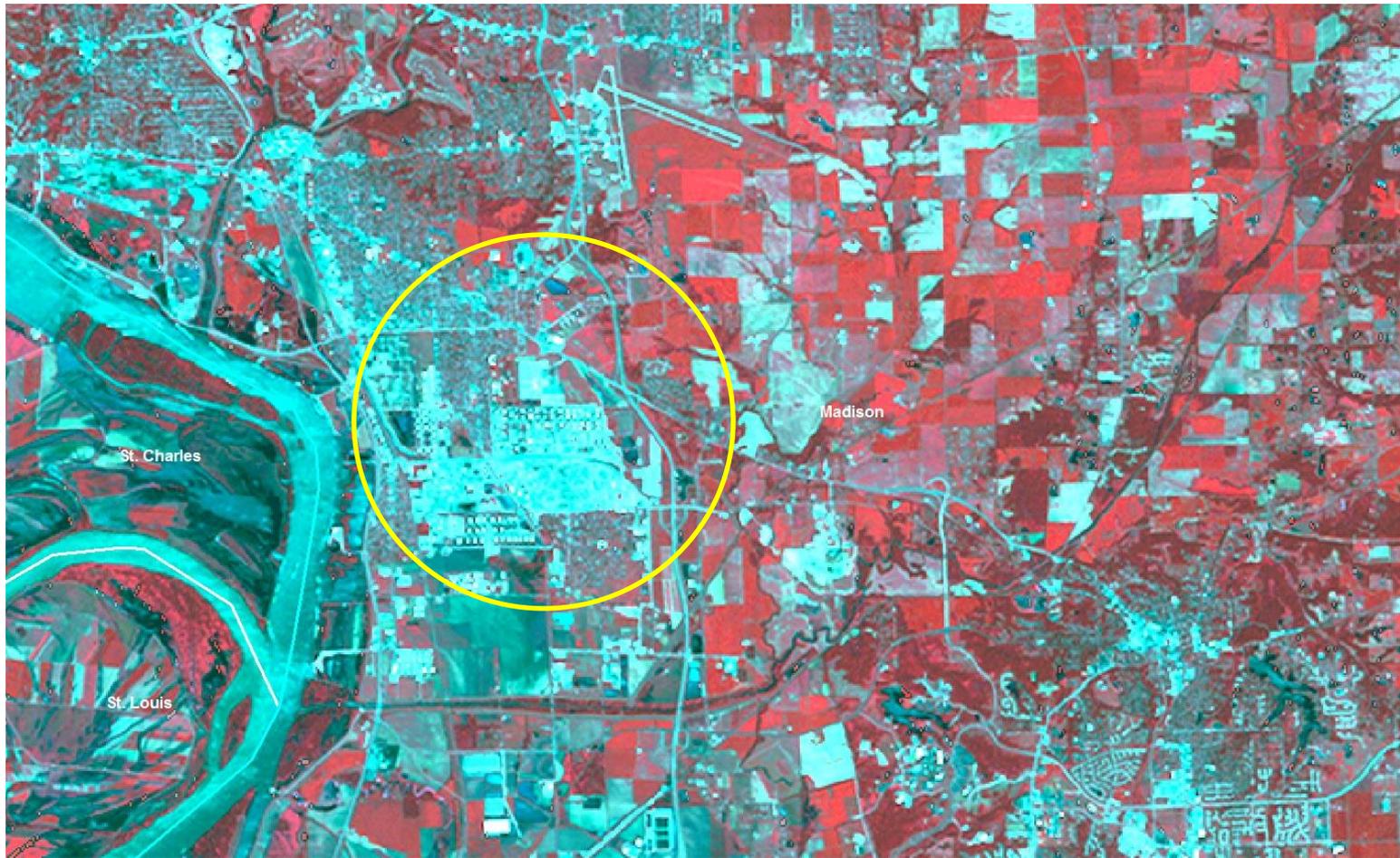
2010 Landsat Imagery



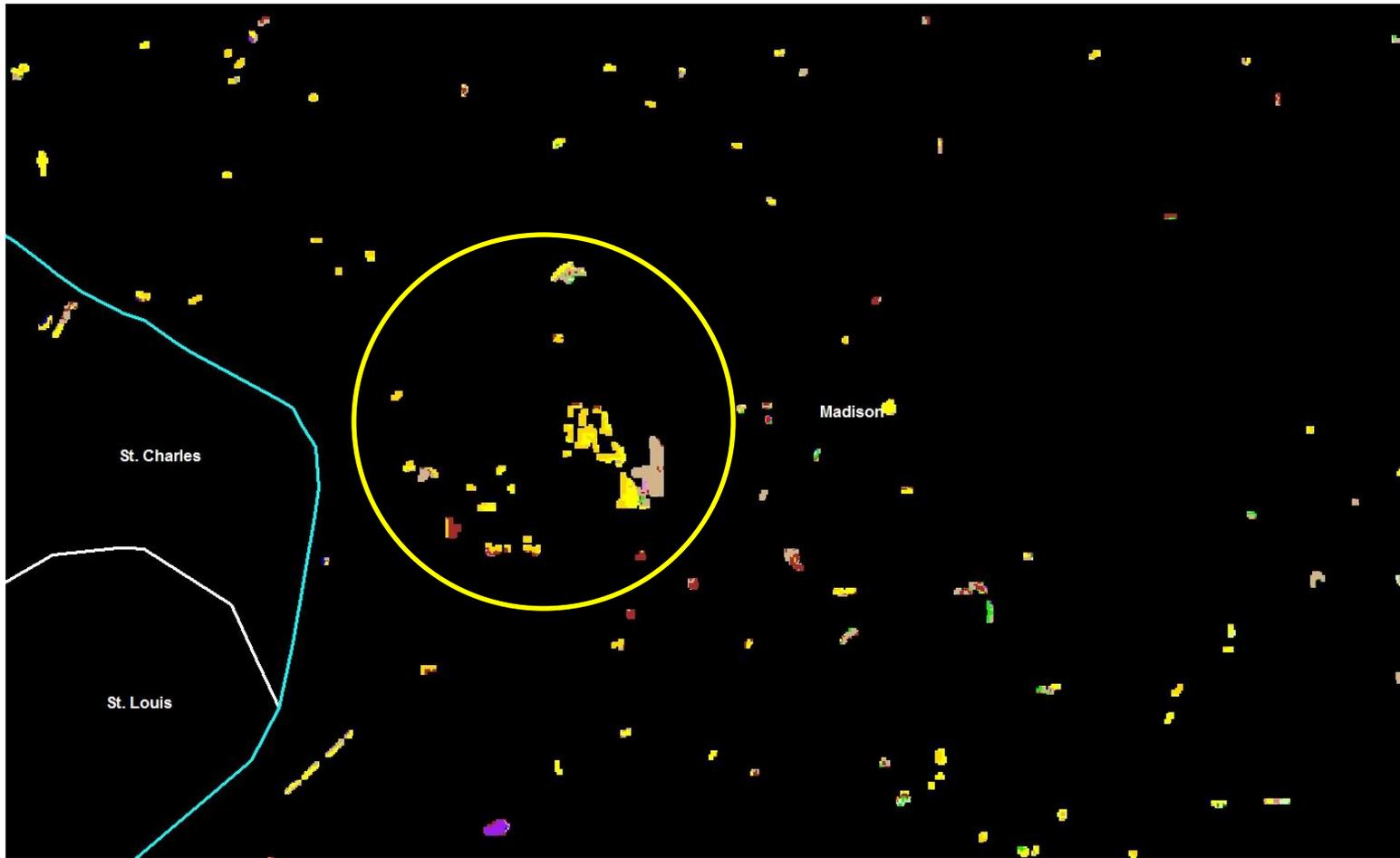
LULC Change



LULC Change



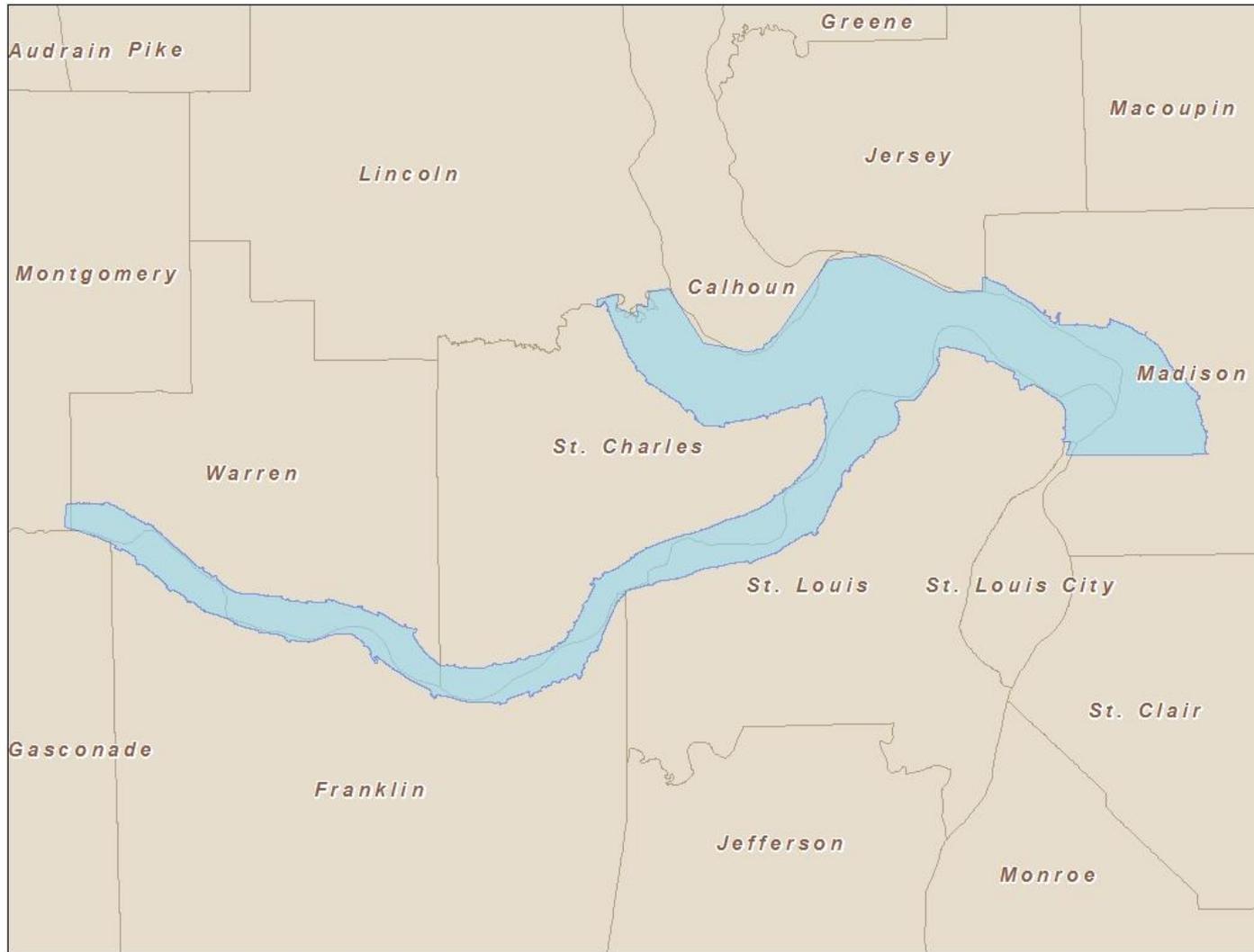
LULC Change



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

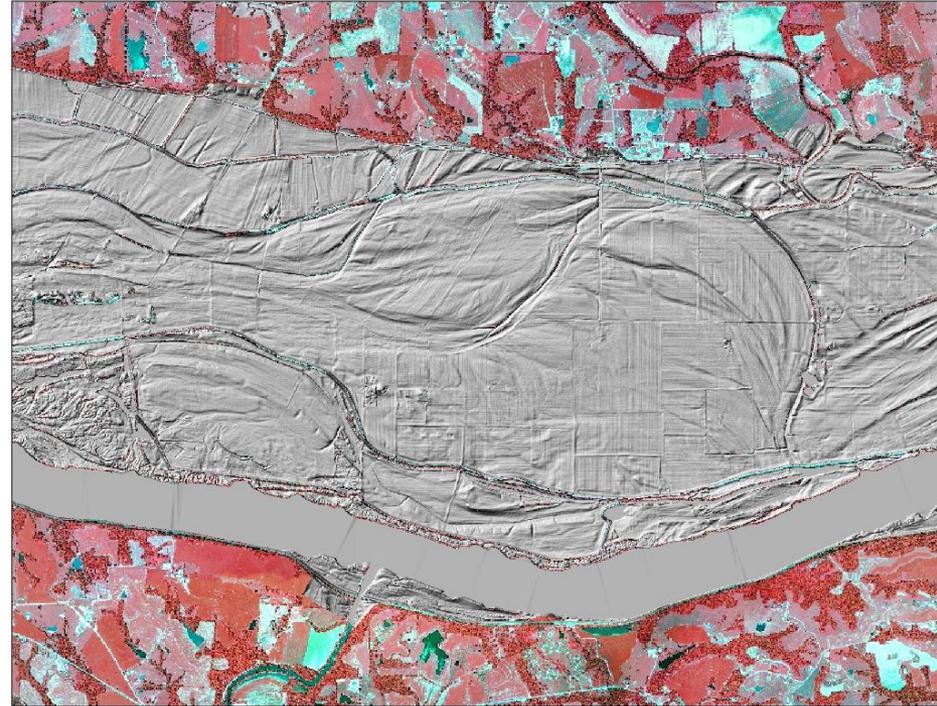
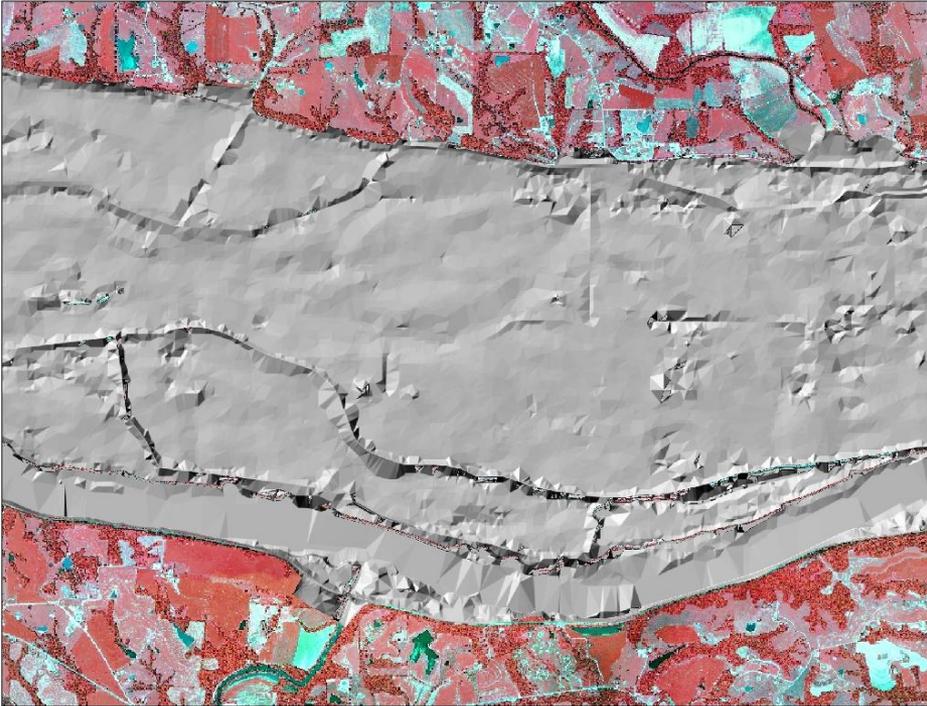
East-West Gateway Missouri River Wetlands Study Area



DEM Comparison

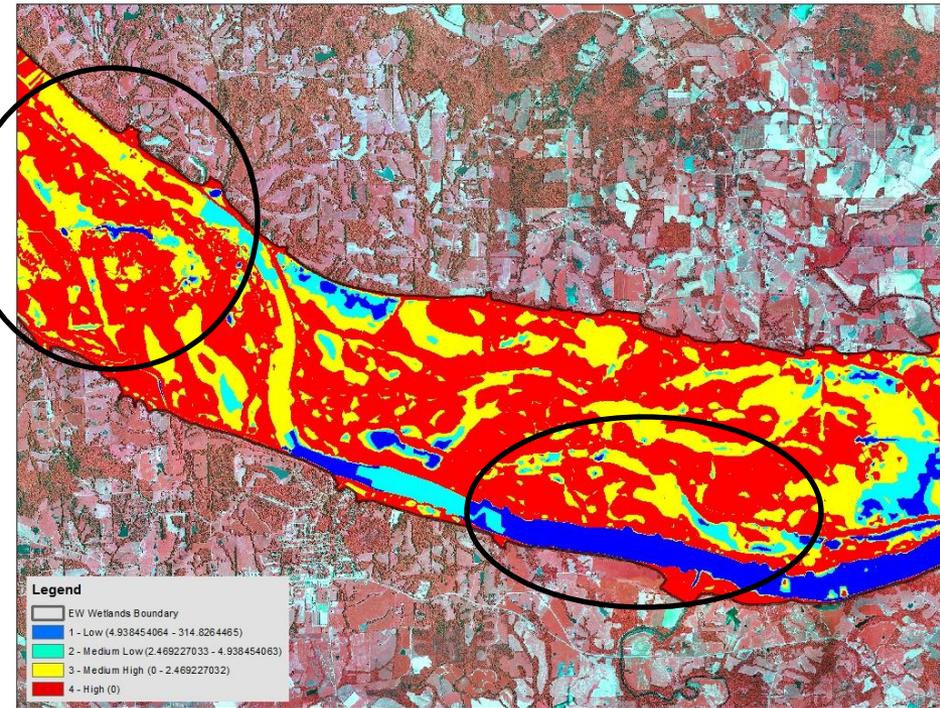
2006 COE 5 meter DEM

2008 – 2010 LiDAR 5 meter DEM

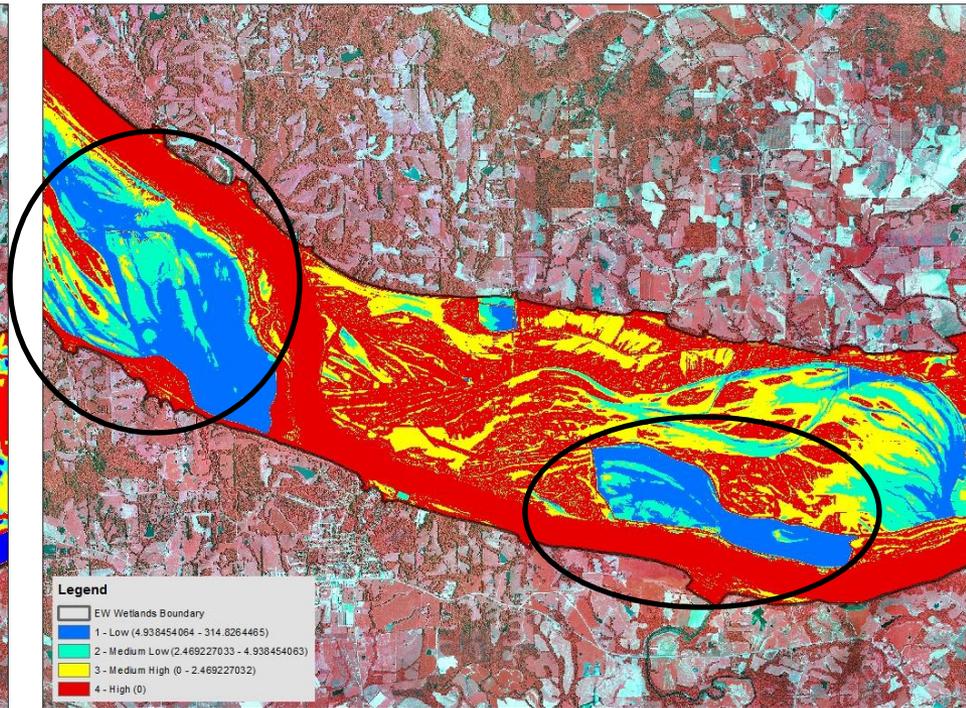


LiDAR vs. COE DEM Sinks Comparison

COE 5 m Sinks

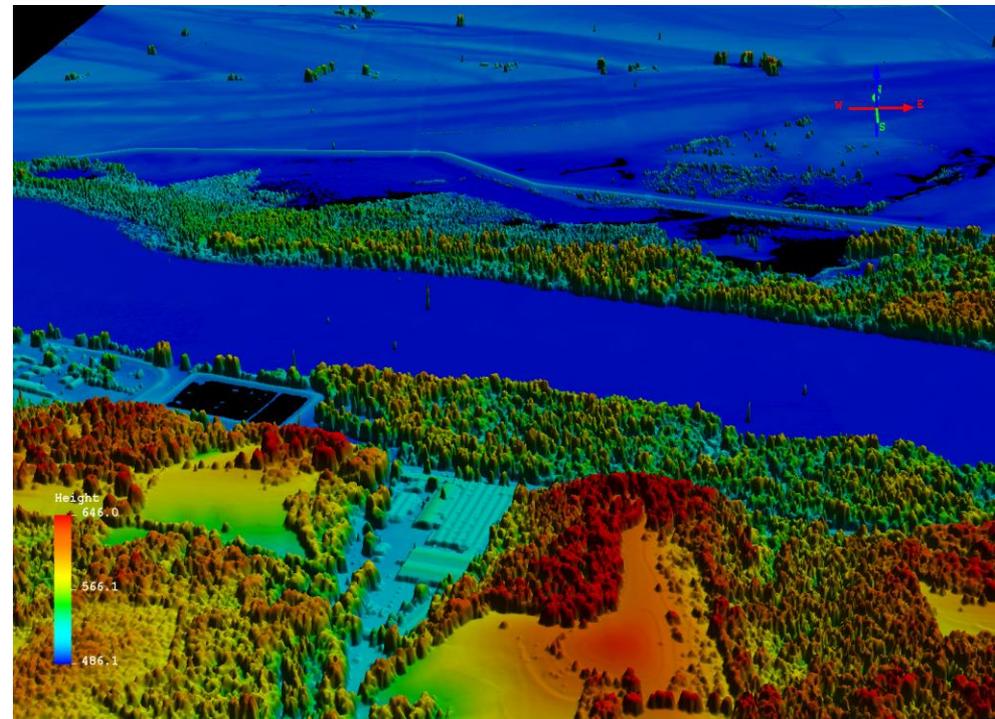


LiDAR 5 m Sinks

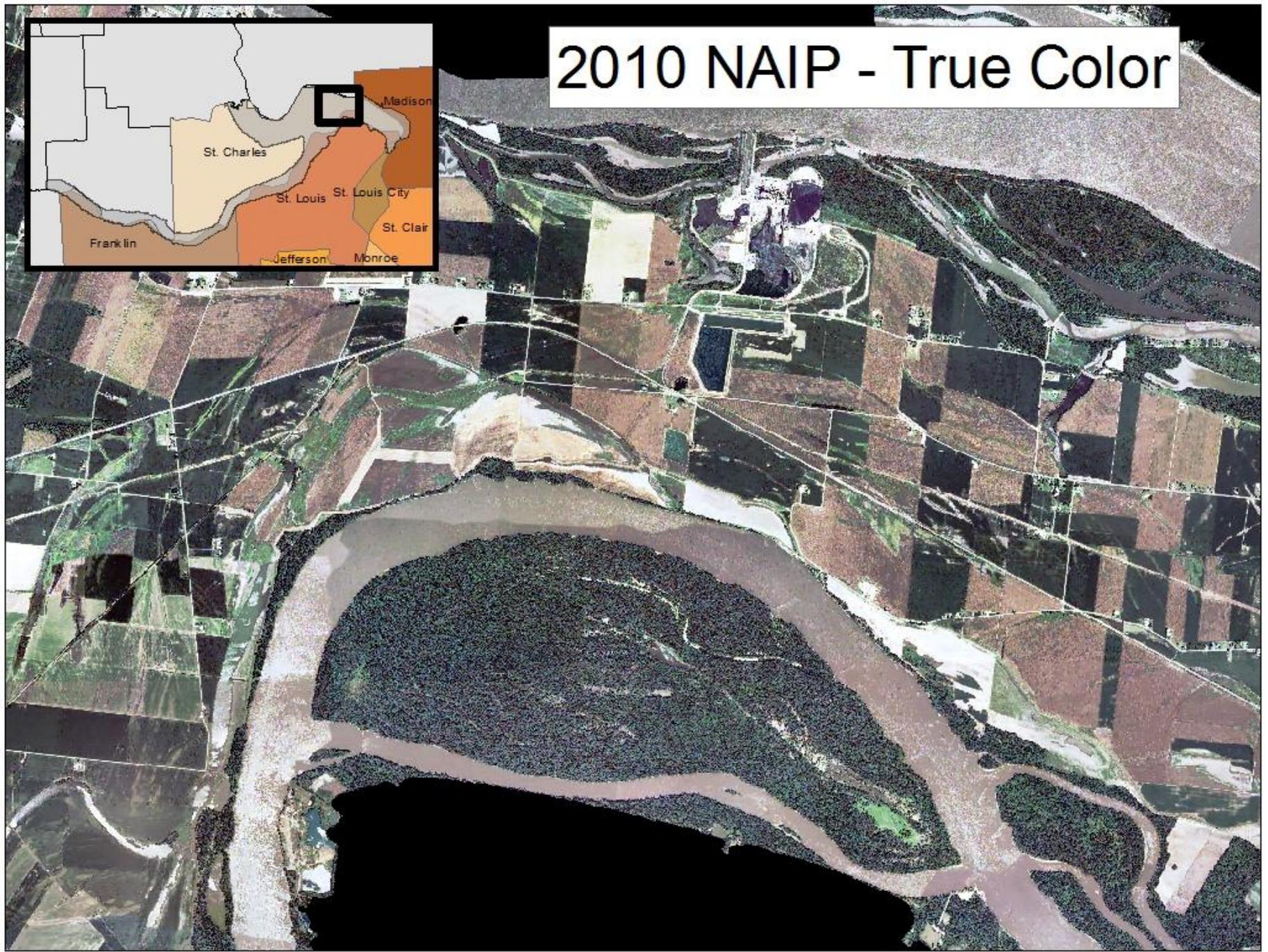
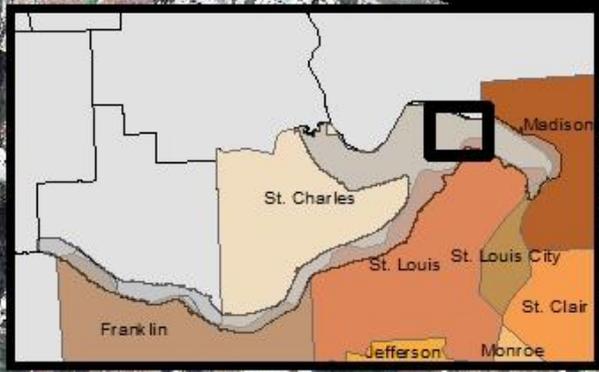


Current Wetland Vegetation Mapping Process

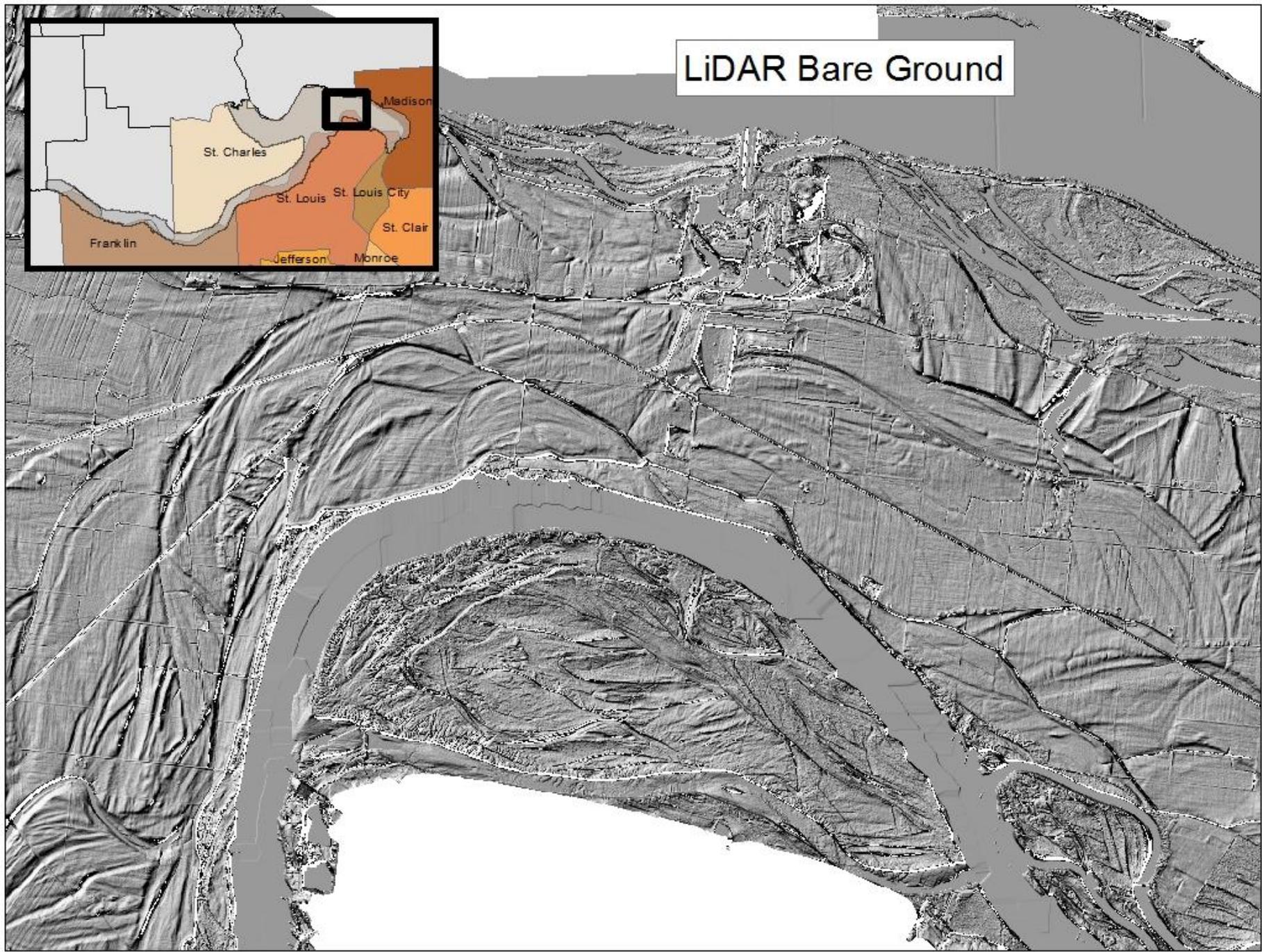
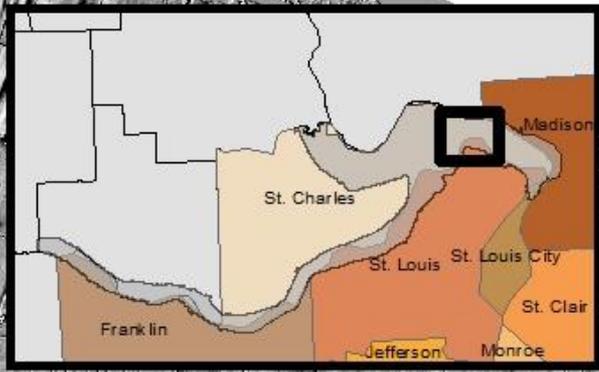
- Land Use Land Cover
- Vegetation Height
- Object delineation of homogeneous features on landscape



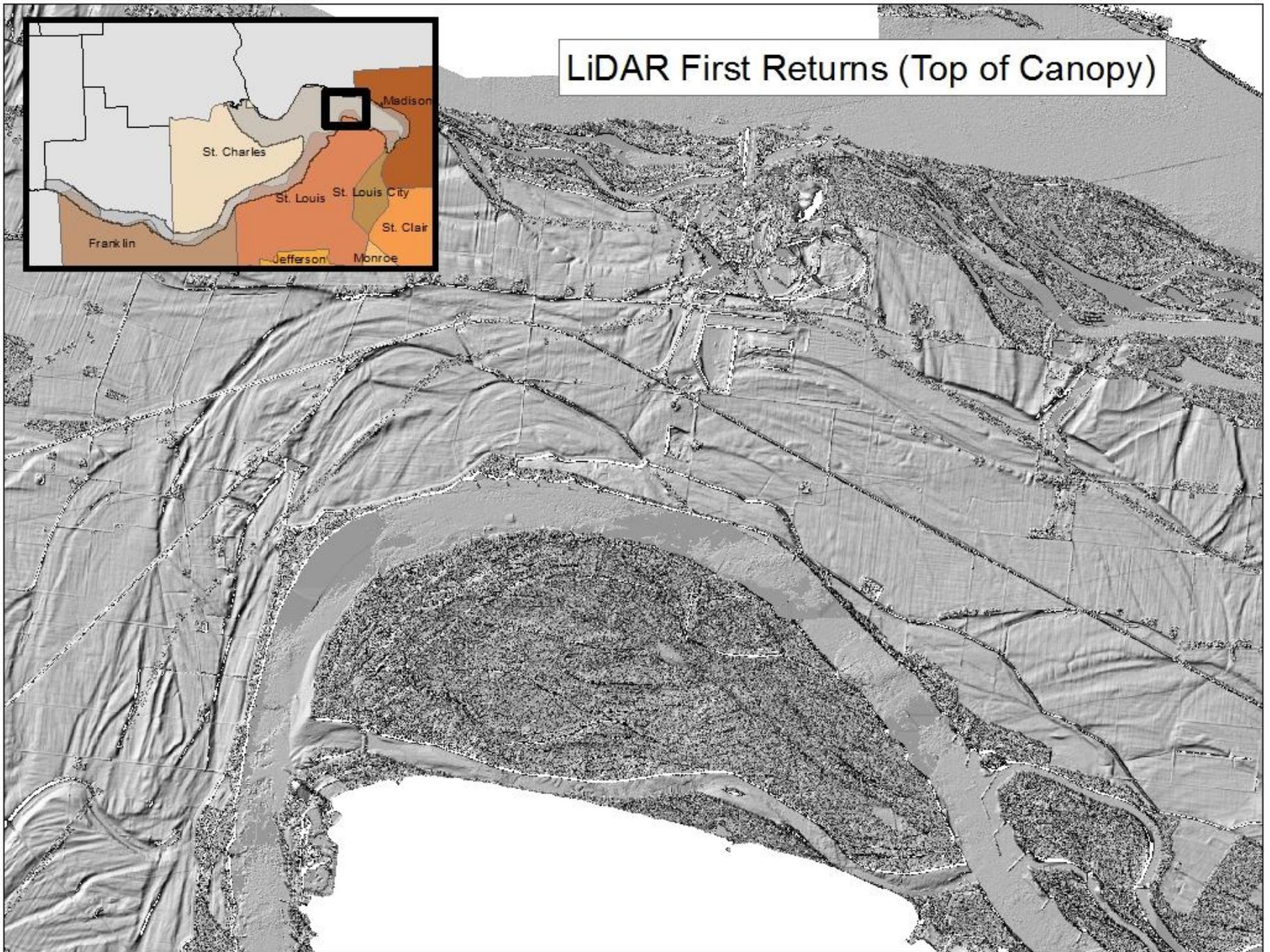
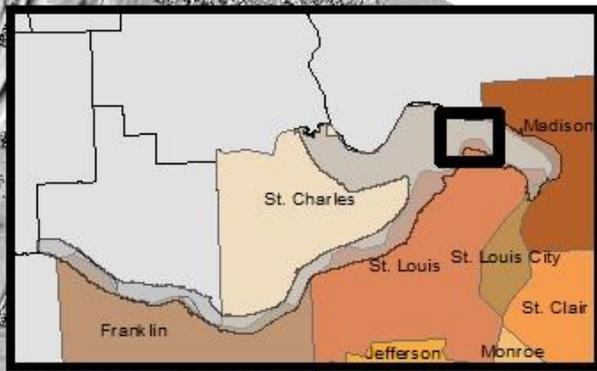
2010 NAIP - True Color



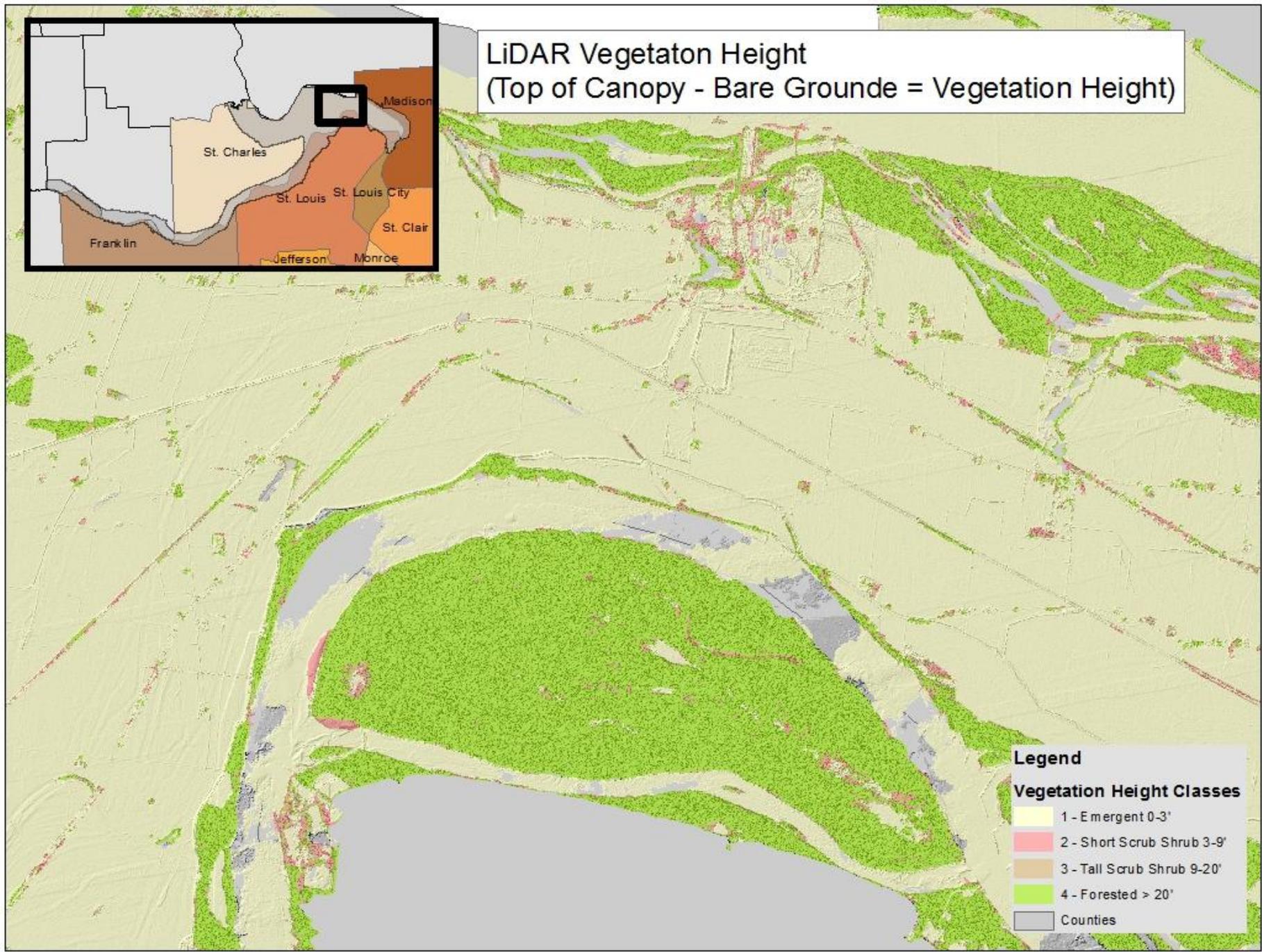
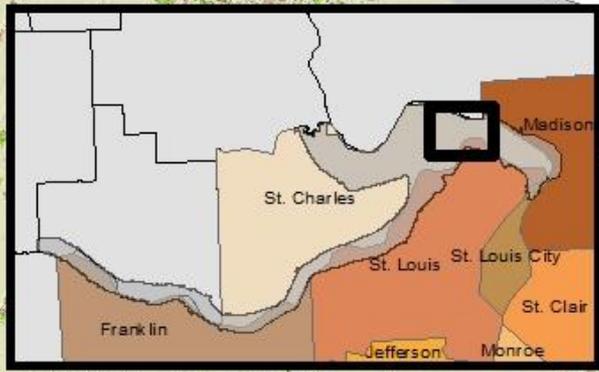
LiDAR Bare Ground



LiDAR First Returns (Top of Canopy)



LiDAR Vegetation Height (Top of Canopy - Bare Ground = Vegetation Height)

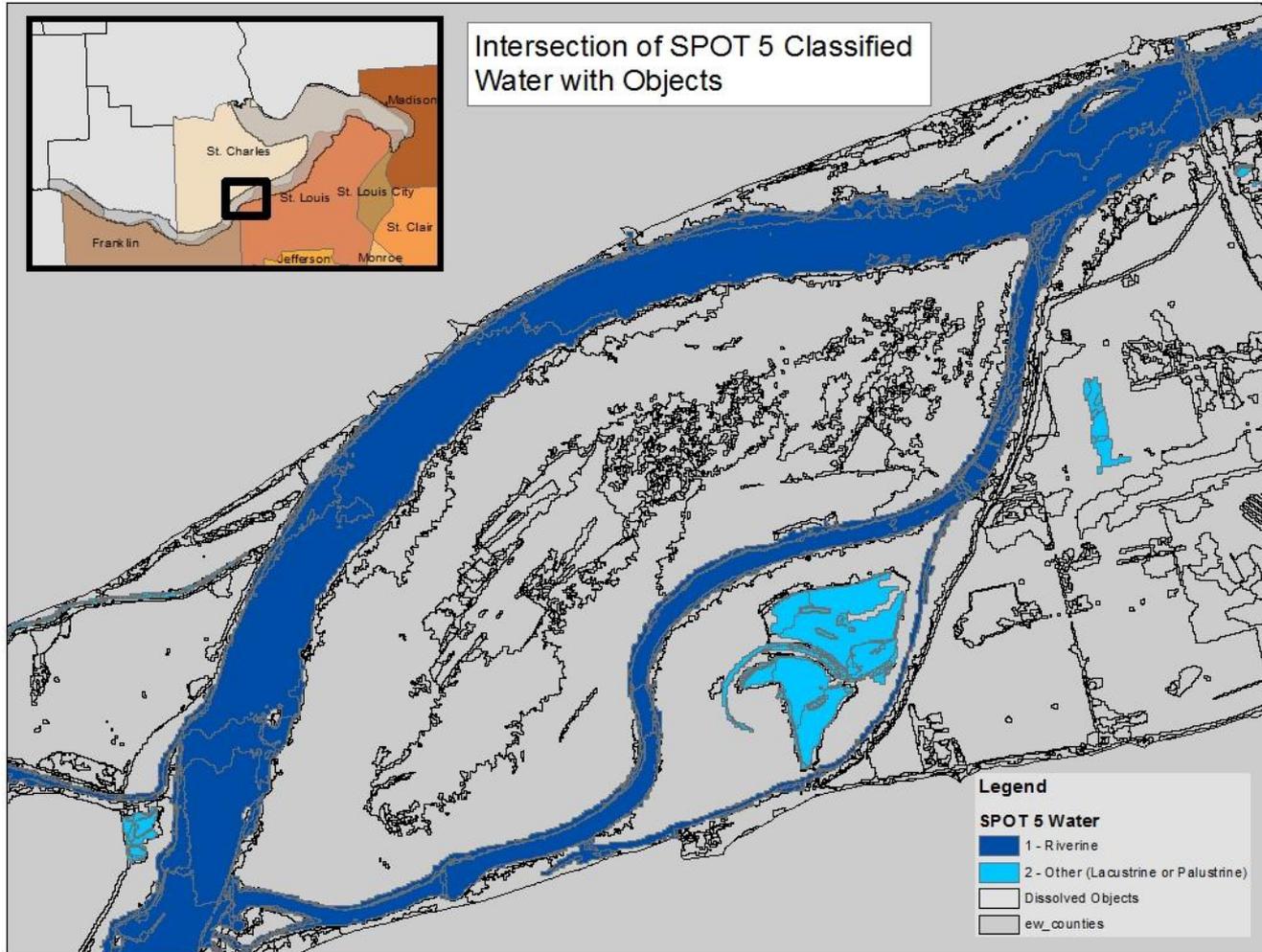


Legend

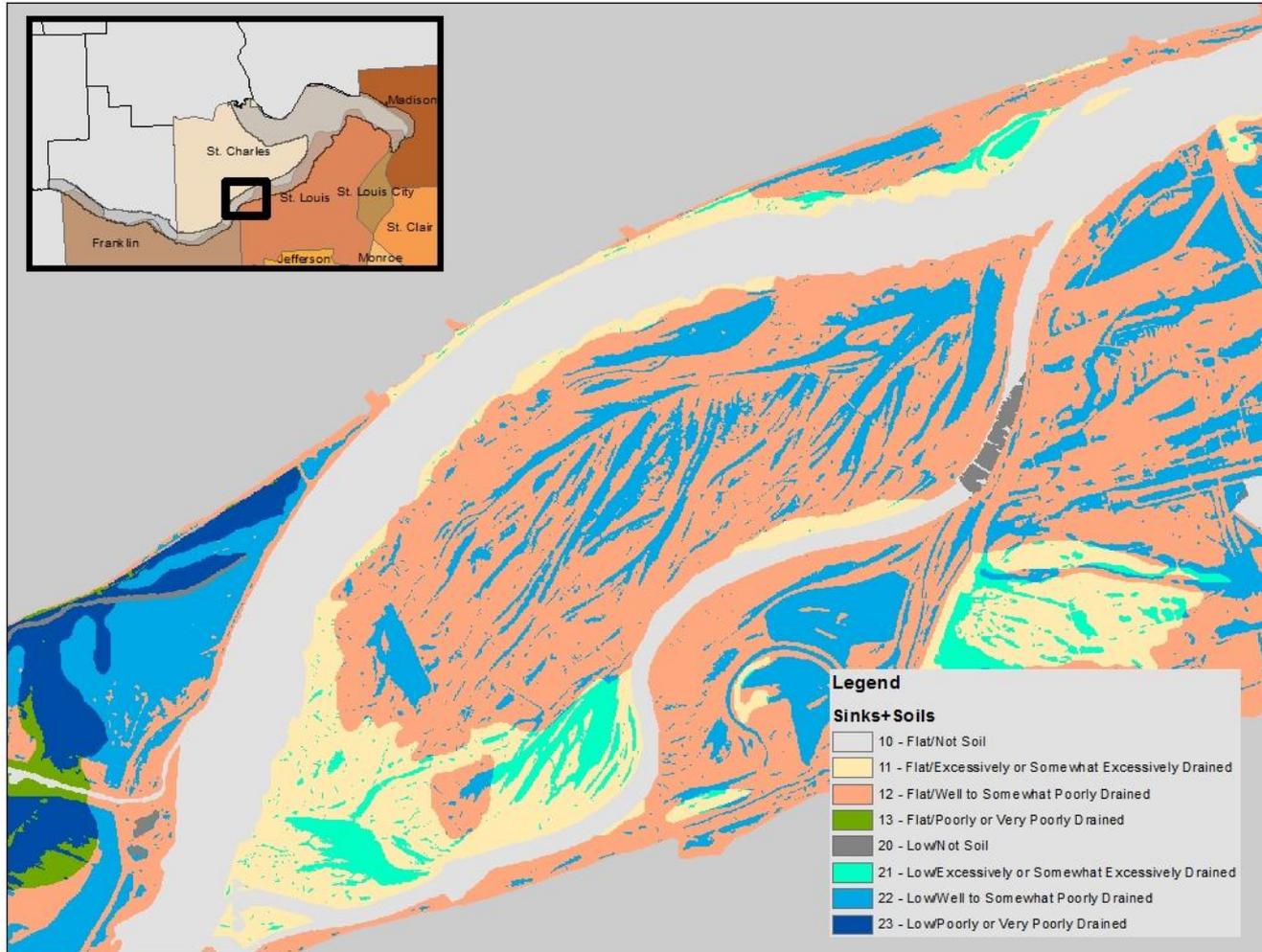
Vegetation Height Classes

- 1 - Emergent 0-3'
- 2 - Short Scrub Shrub 3-9'
- 3 - Tall Scrub Shrub 9-20'
- 4 - Forested > 20'
- Counties

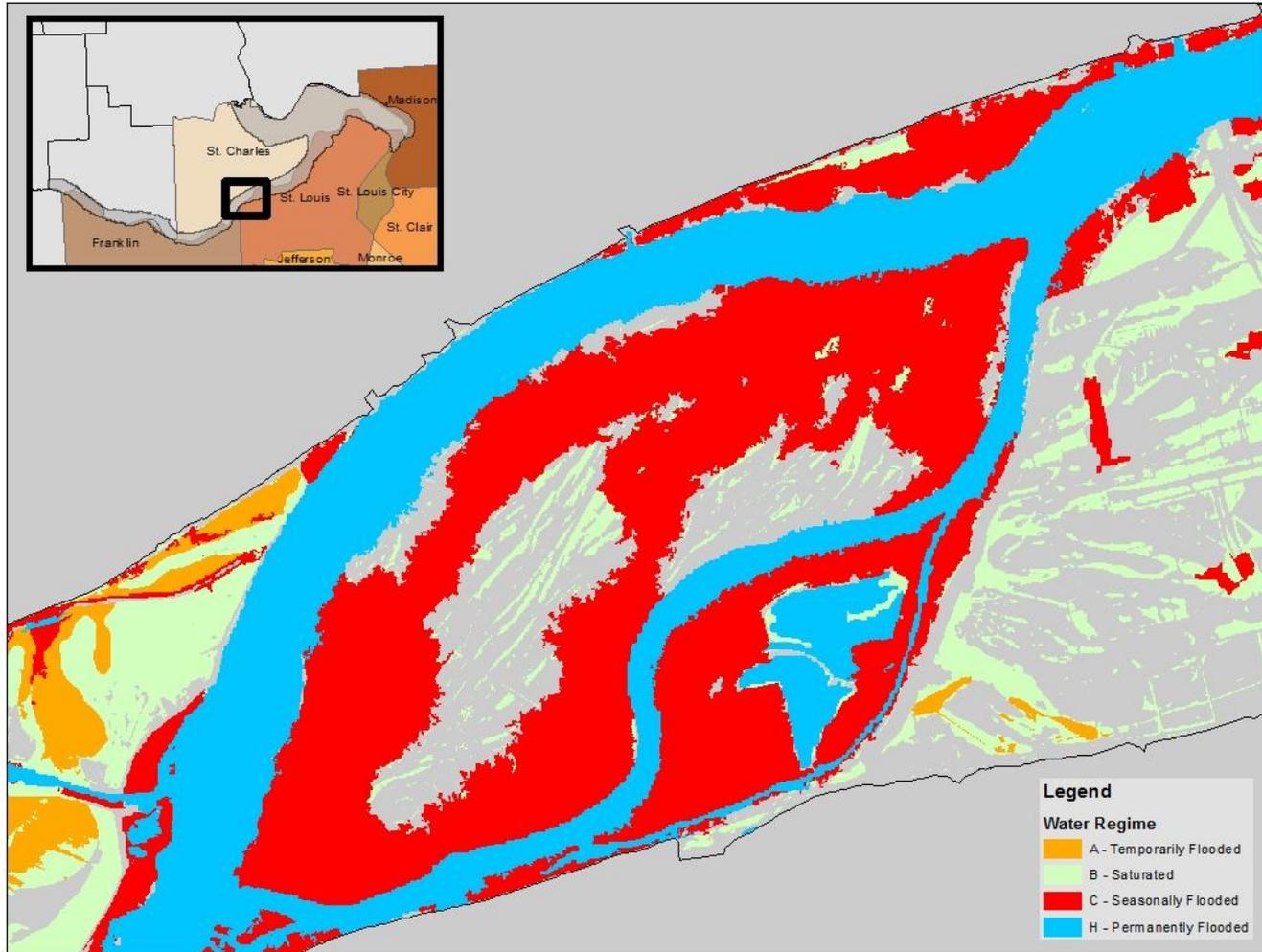
System - SPOT 5 Water



Water Regime – Sinks+Soils

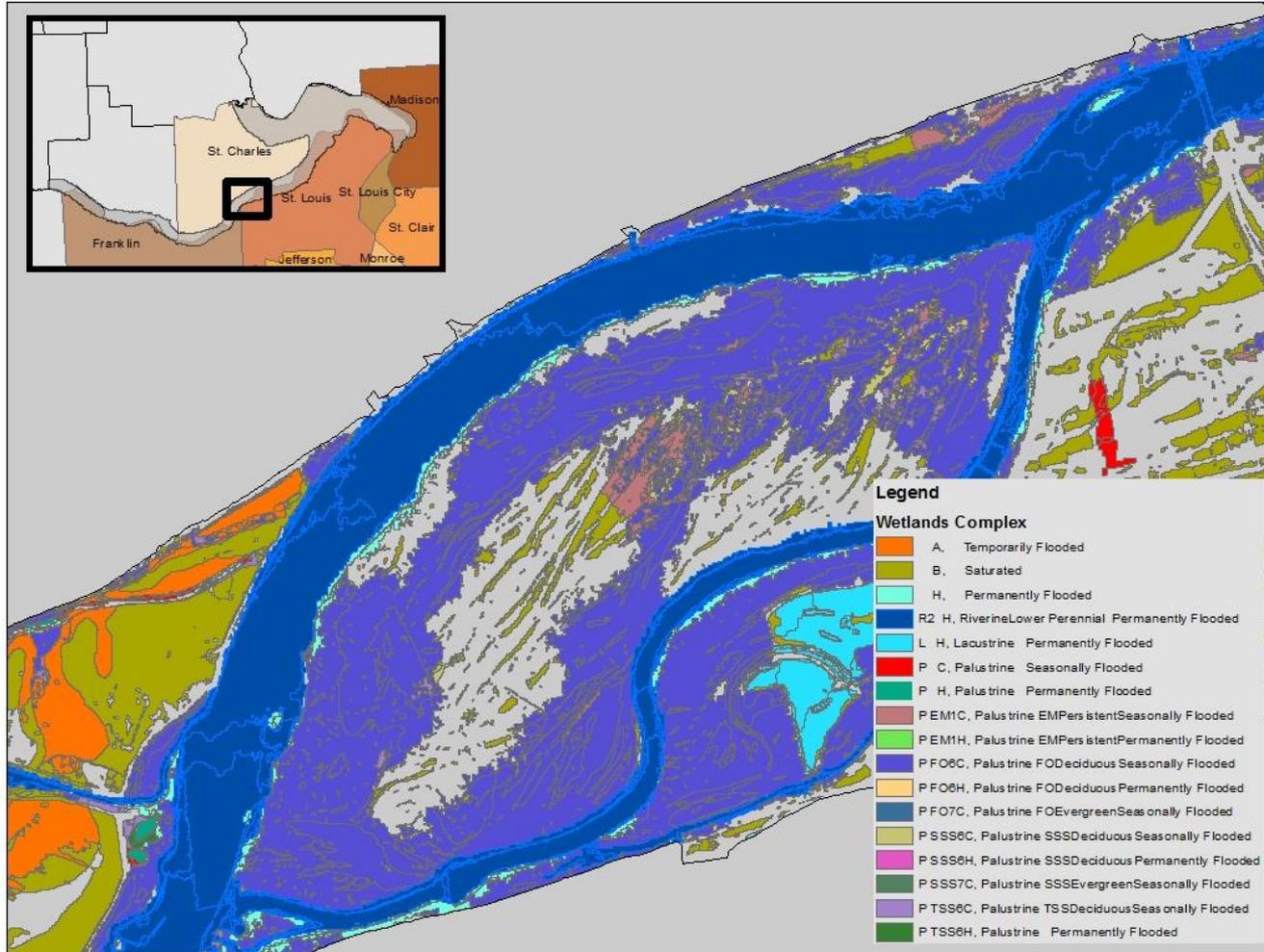


Water Regime – Sinks+Soils



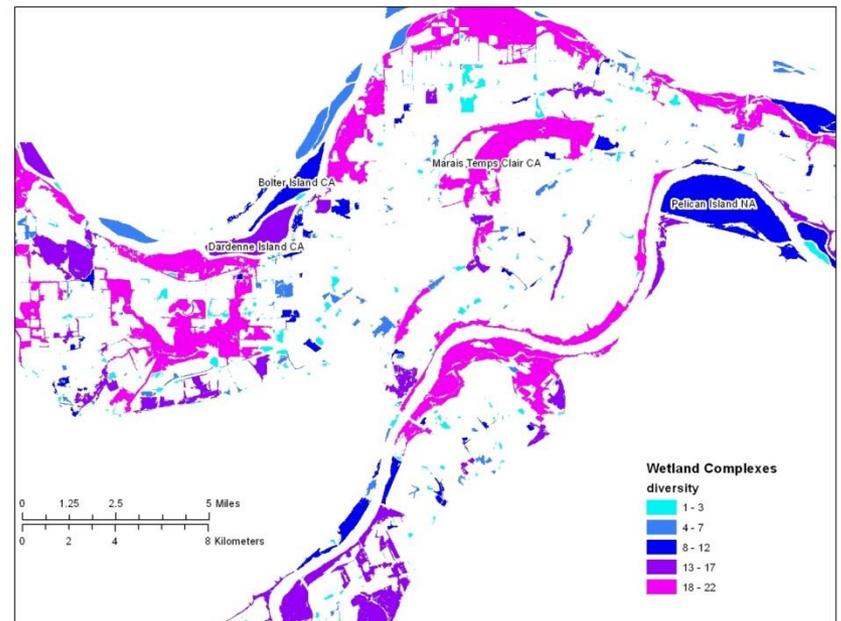
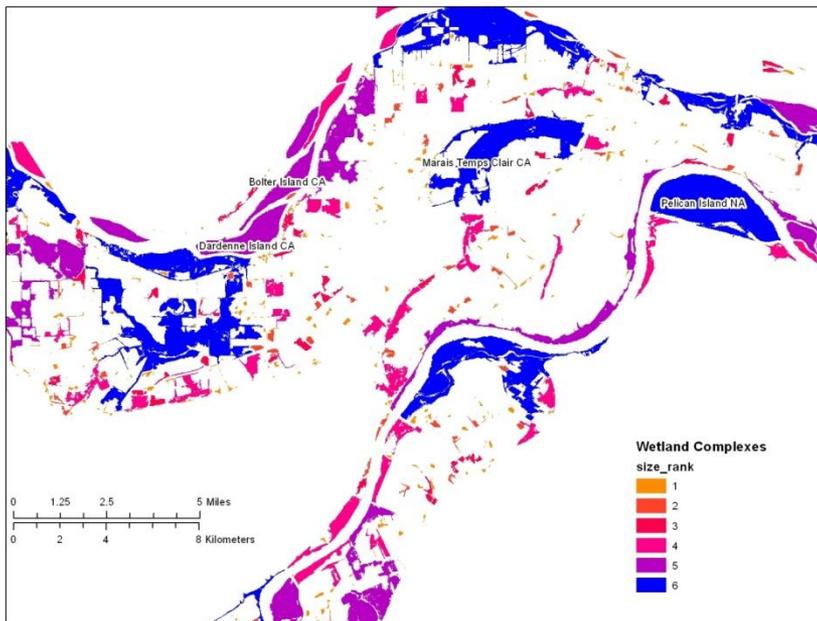
Wetland Classification

- 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



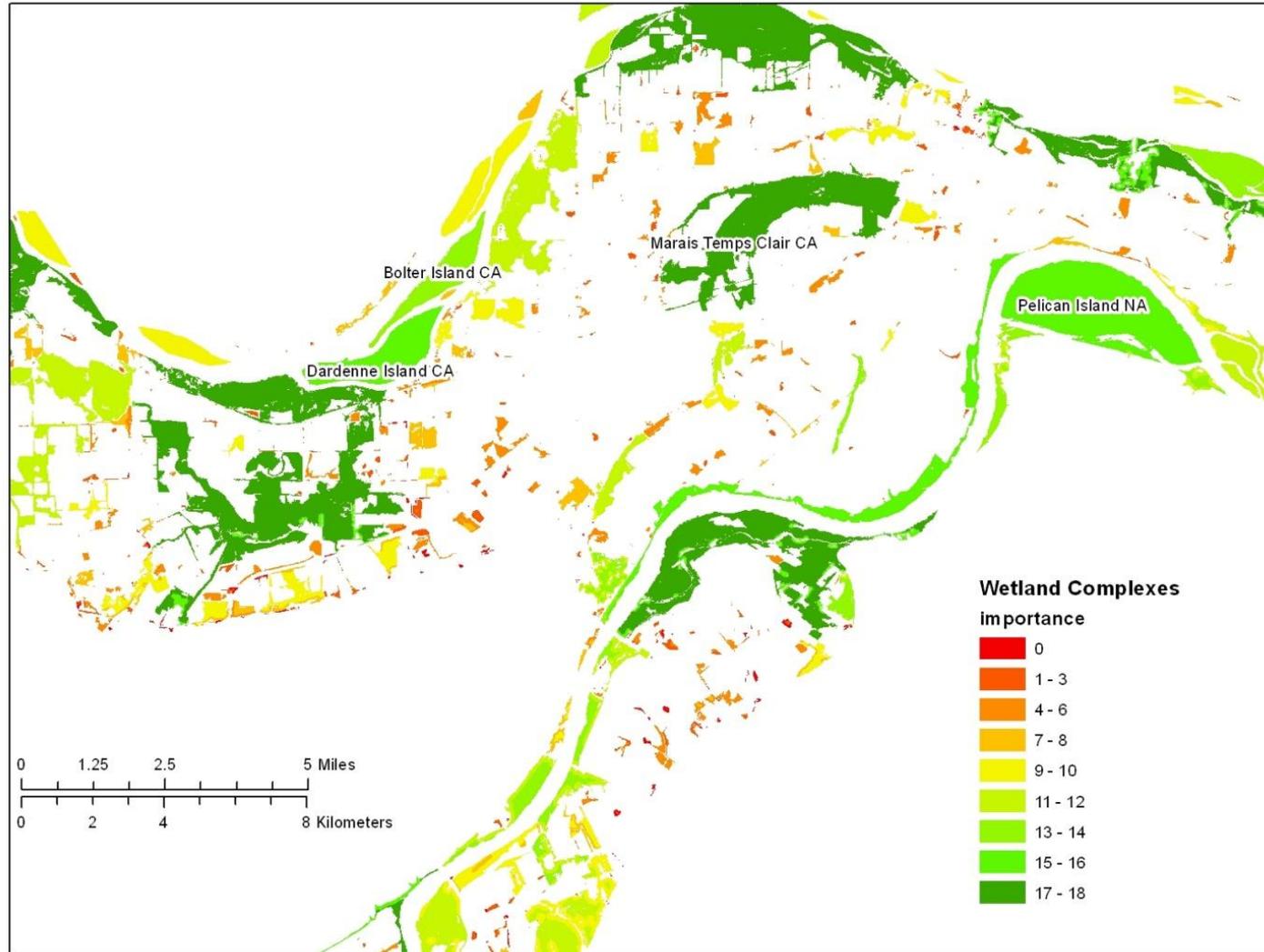
Wetland Complex Importance

Weighted Patch Size

Diversity

Distance to
Protected Lands

Distance to Urban
Lands



Wetland Restoration Rank

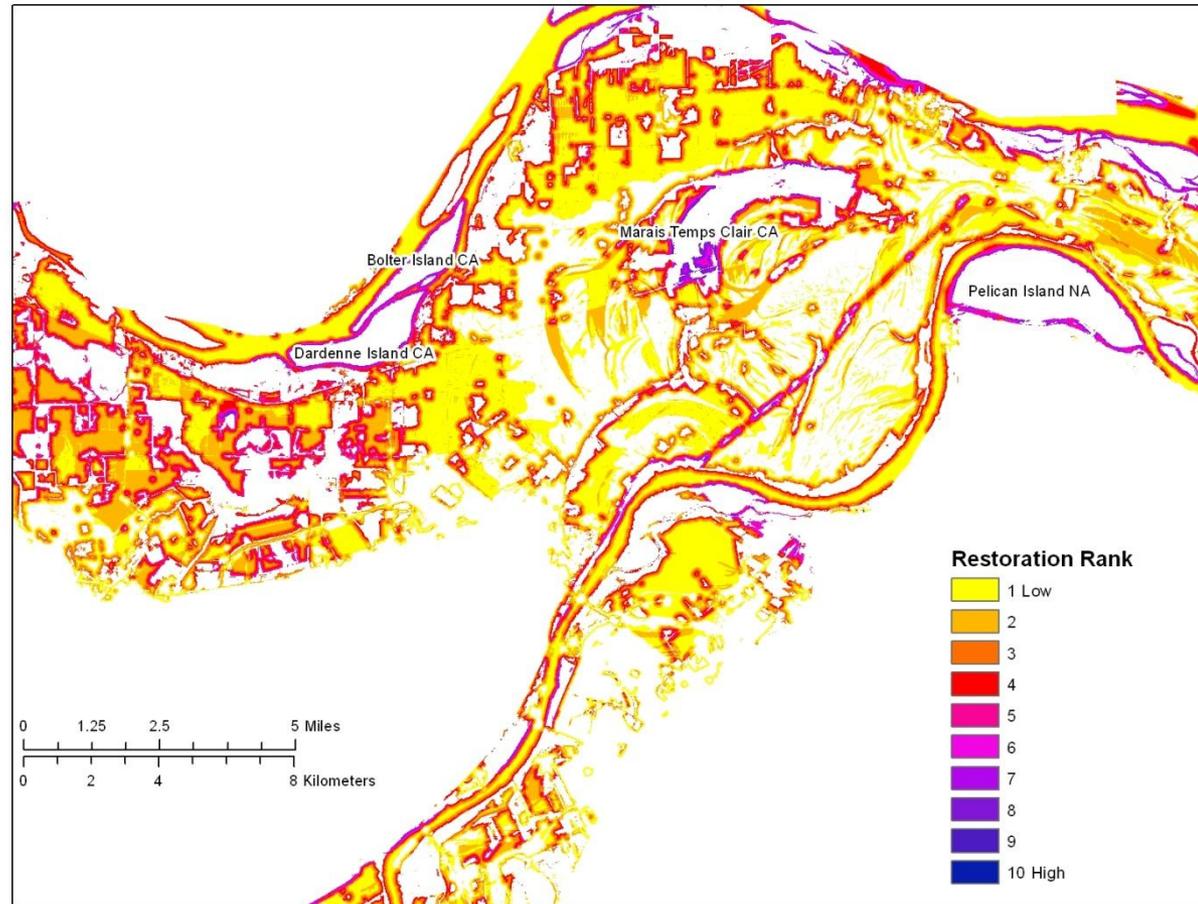
Water Regime

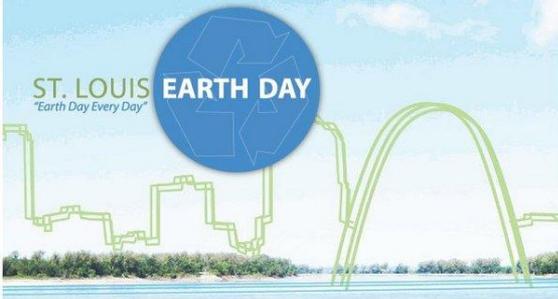
Distance to Protected Lands

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

