Development of New Data to Inform Planning for the East-West Gateway Region

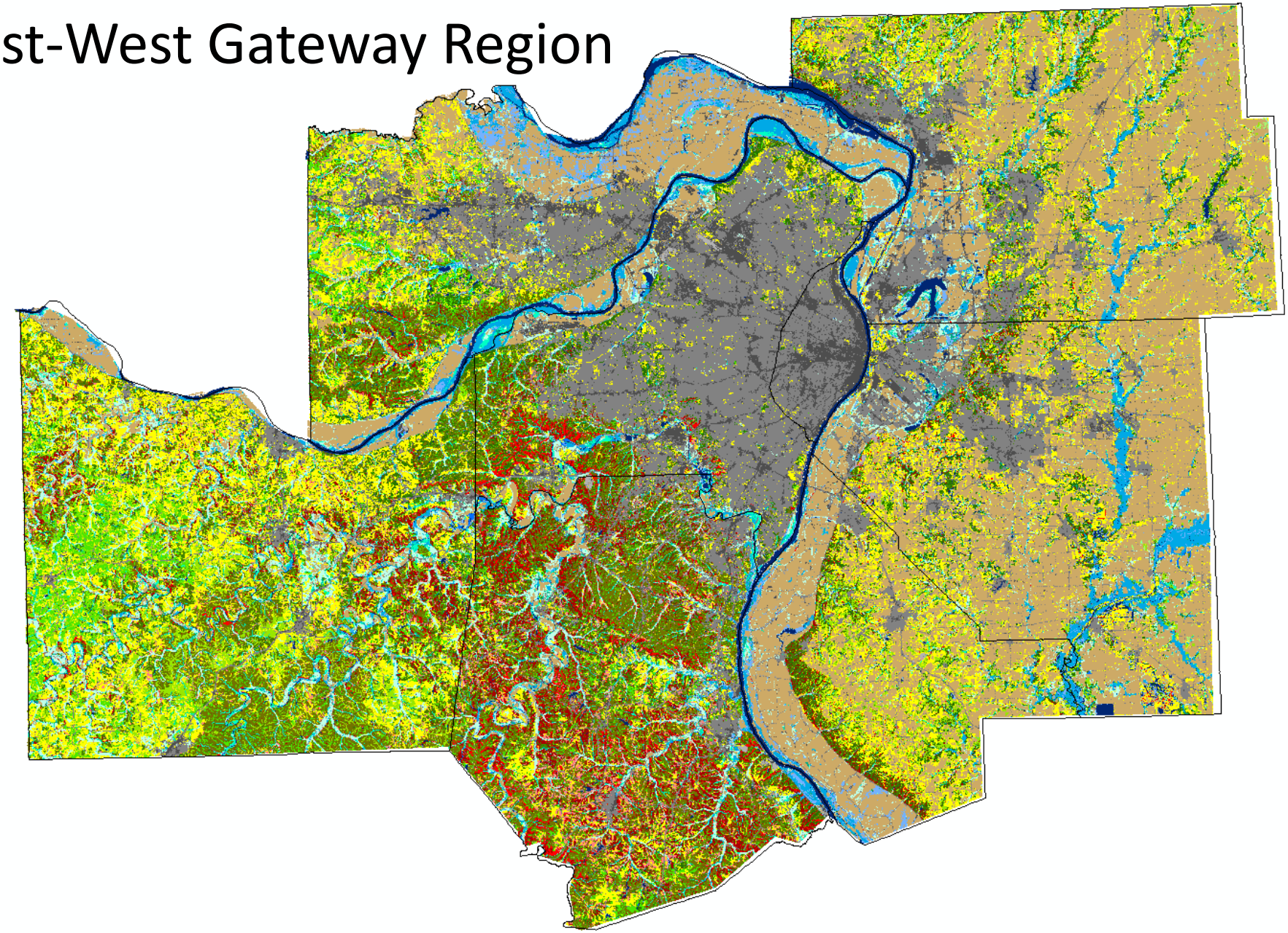
April 5, 2012

David Diamond and Jennifer Reiman

Contact: diamondd@missouri.edu

Contributors: Diane True, Ronnie Lea, Lee Elliott, MoRAP

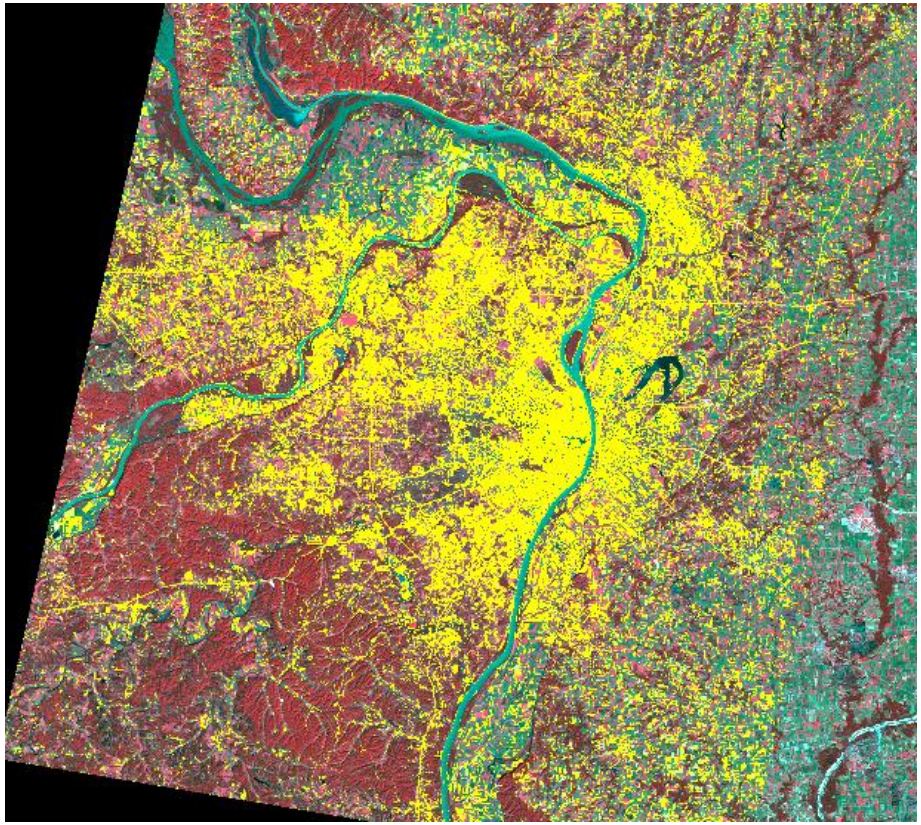
East-West Gateway Region



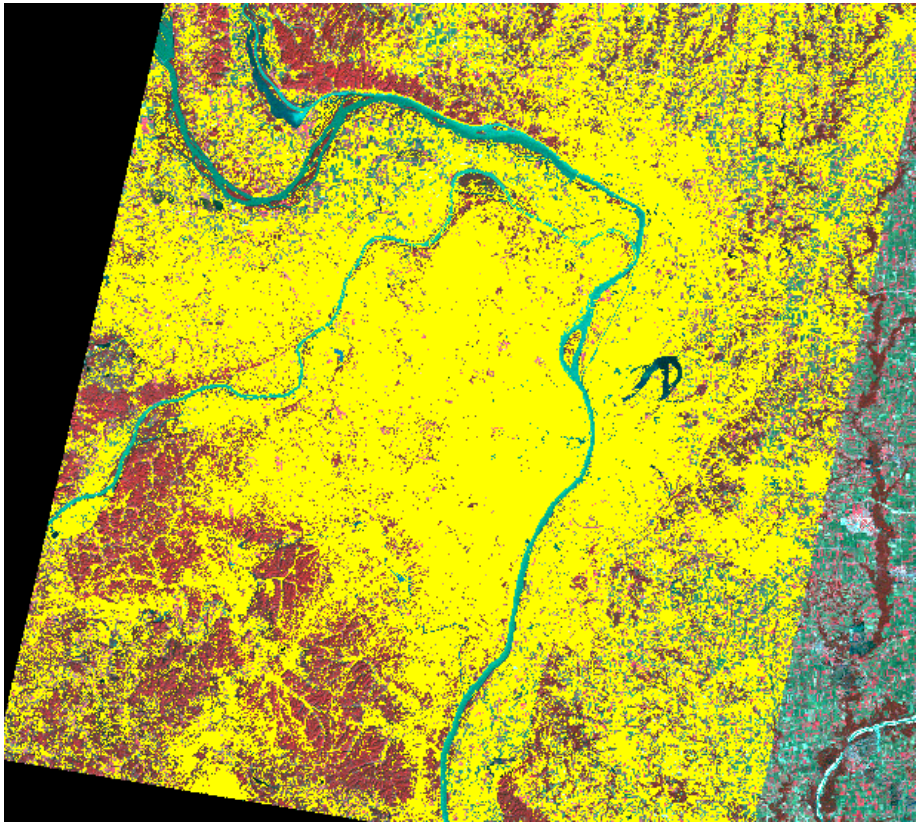
St. Louis, MO

Lost 965 square miles to urban development

1972



1999

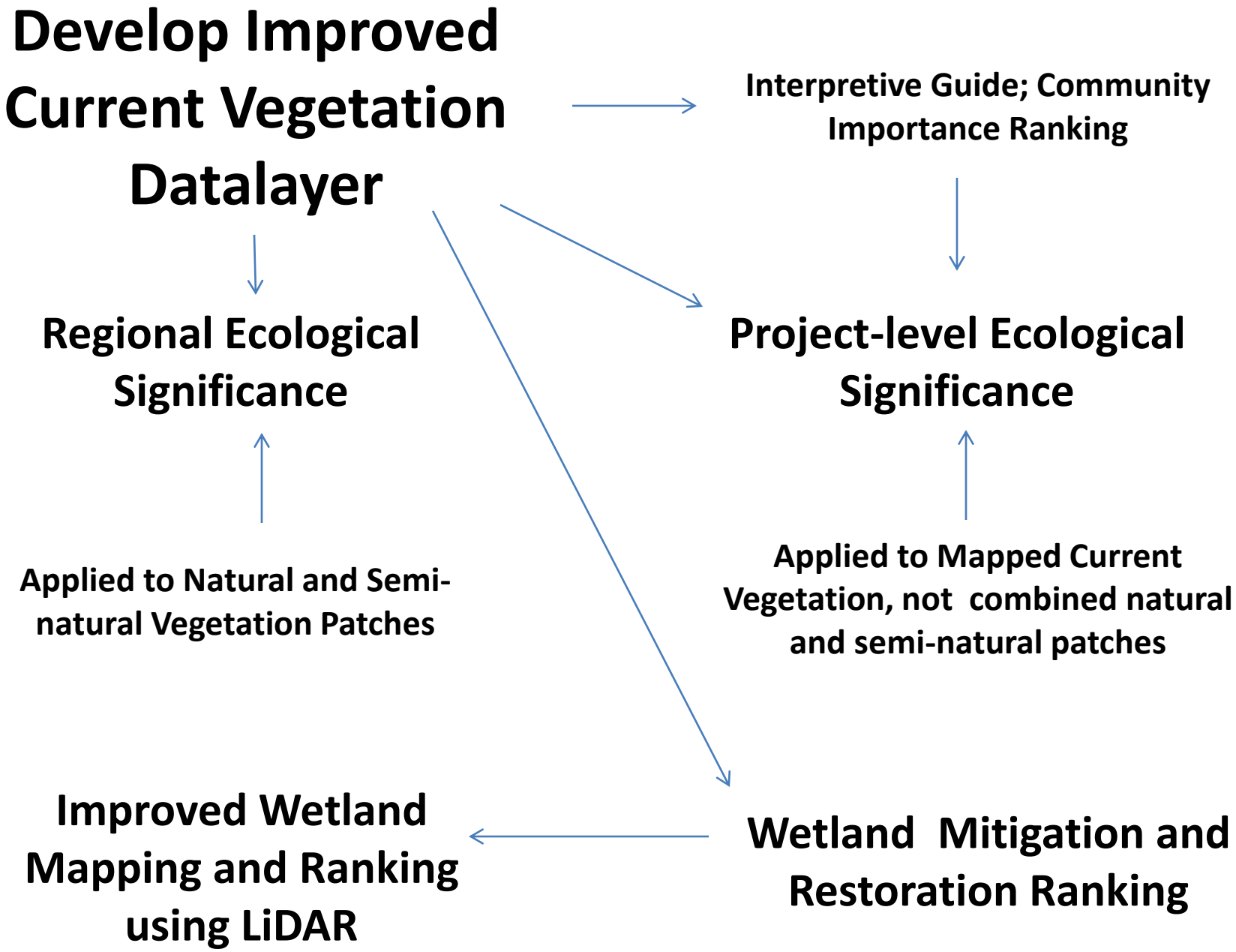


Situation

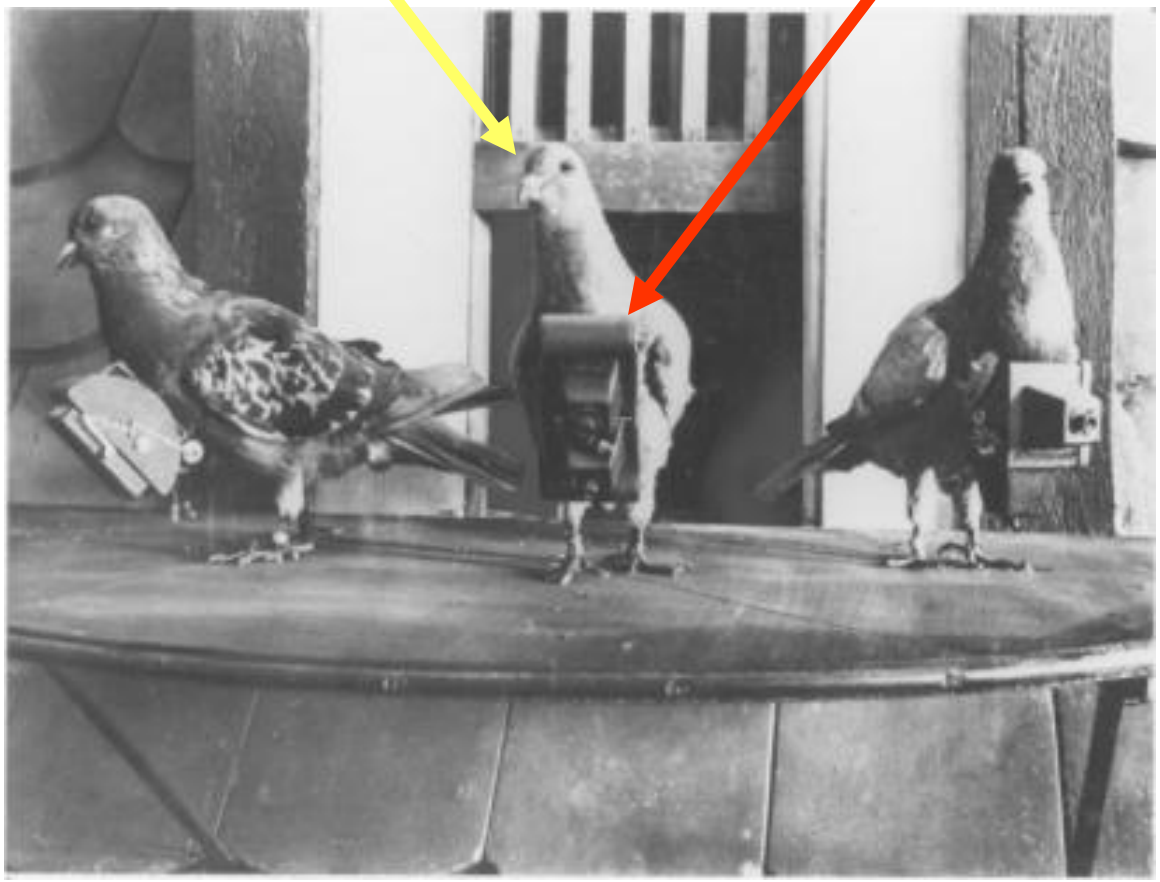
- Conversion of natural landscapes to urban infrastructure is on-going and rapid
- Conservation efforts should be directed toward priority needs
- Identification of priority needs requires good information on landscapes, communities, and species

Guiding Criteria

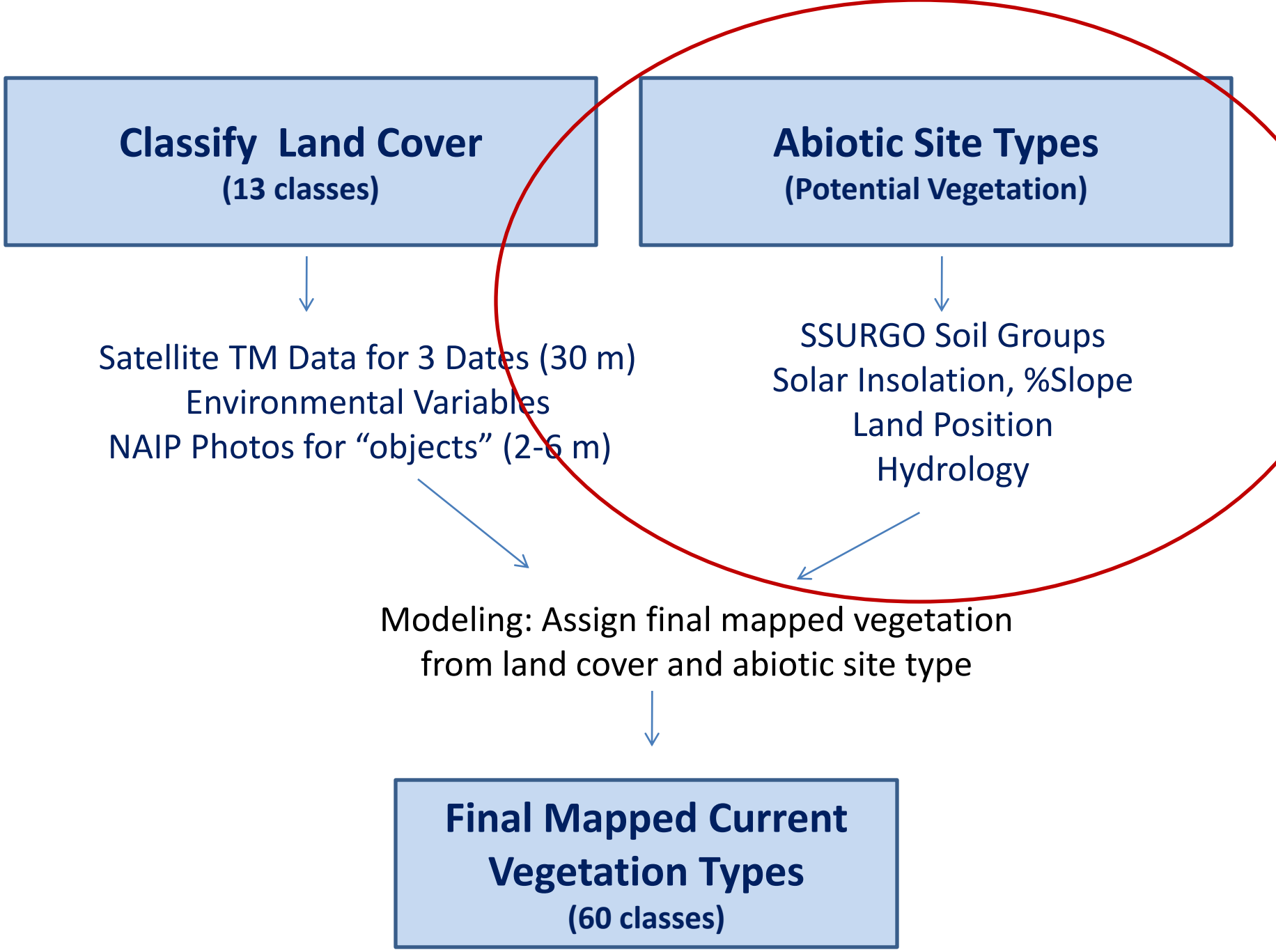
- Provide results that improve conservation outcomes
- Products easily understood and up-dated
- Requires enhanced **mapping of current vegetation, followed by ranking (regional, project-level, wetlands)** and use by multiple partners


Develop Improved Current Vegetation Datalayer
Interpretive Guide; Community Importance Ranking
Regional Ecological Significance
Project-level Ecological Significance
Applied to Natural and Semi-natural Vegetation Patches
Applied to Mapped Current Vegetation, not combined natural and semi-natural patches
Improved Wetland Mapping and Ranking using LiDAR
Wetland Mitigation and Restoration Ranking

Platform and Sensor



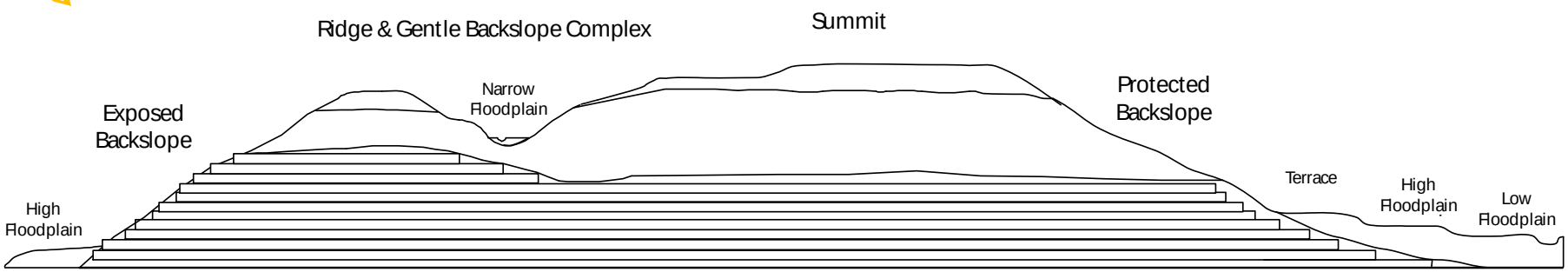
We did our own remote sensing


Classify Land Cover
(13 classes)
Abiotic Site Types
(Potential Vegetation)
Satellite TM Data for 3 Dates (30 m)
Environmental Variables
NAIP Photos for "objects" (2-6 m)
SSURGO Soil Groups
Solar Insolation, %Slope
Land Position
Hydrology
Modeling: Assign final mapped vegetation
from land cover and abiotic site type
Final Mapped Current
Vegetation Types
(60 classes)

Missouri ELT Development Process

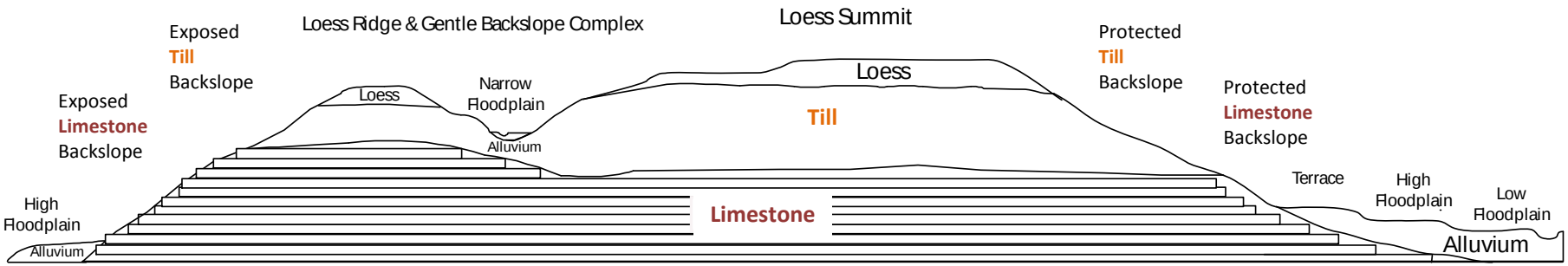
-

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



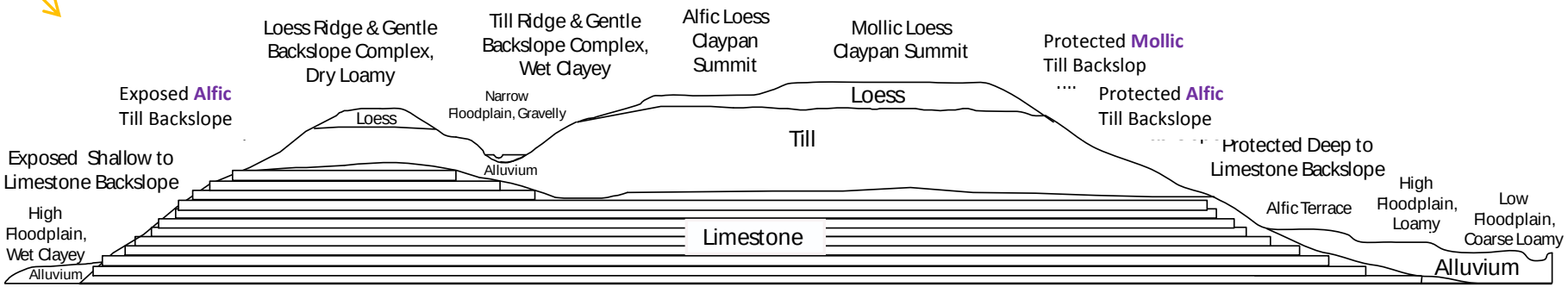
Missouri ELT Development Process

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



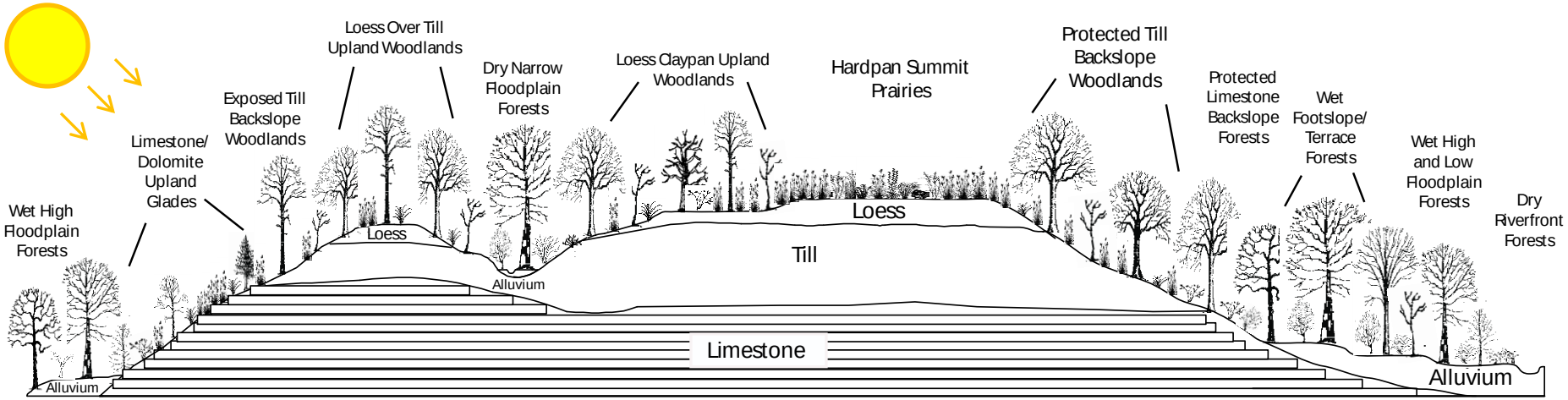
Missouri ELT Development Process

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**.



Classify Land Cover
(13 classes)

Satellite TM Data for 3 Dates (30 m)
Environmental Variables
NAIP Photos for "objects" (2-6 m)

Abiotic Site Types
(Potential Vegetation)

SSURGO Soil Groups
Solar Insolation, %Slope
Land Position
Hydrology

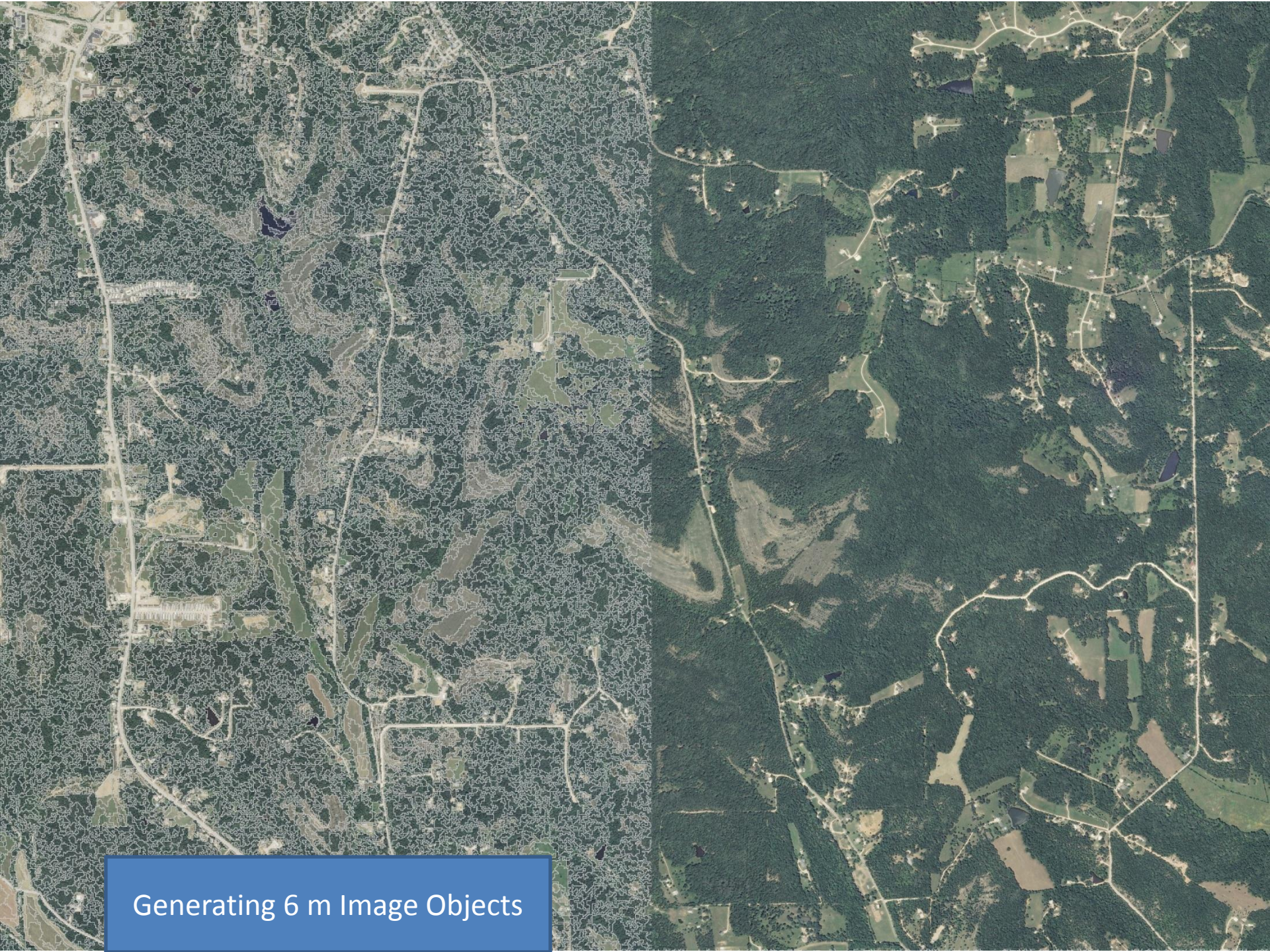
Modeling: Assign final mapped vegetation from land cover and abiotic site type

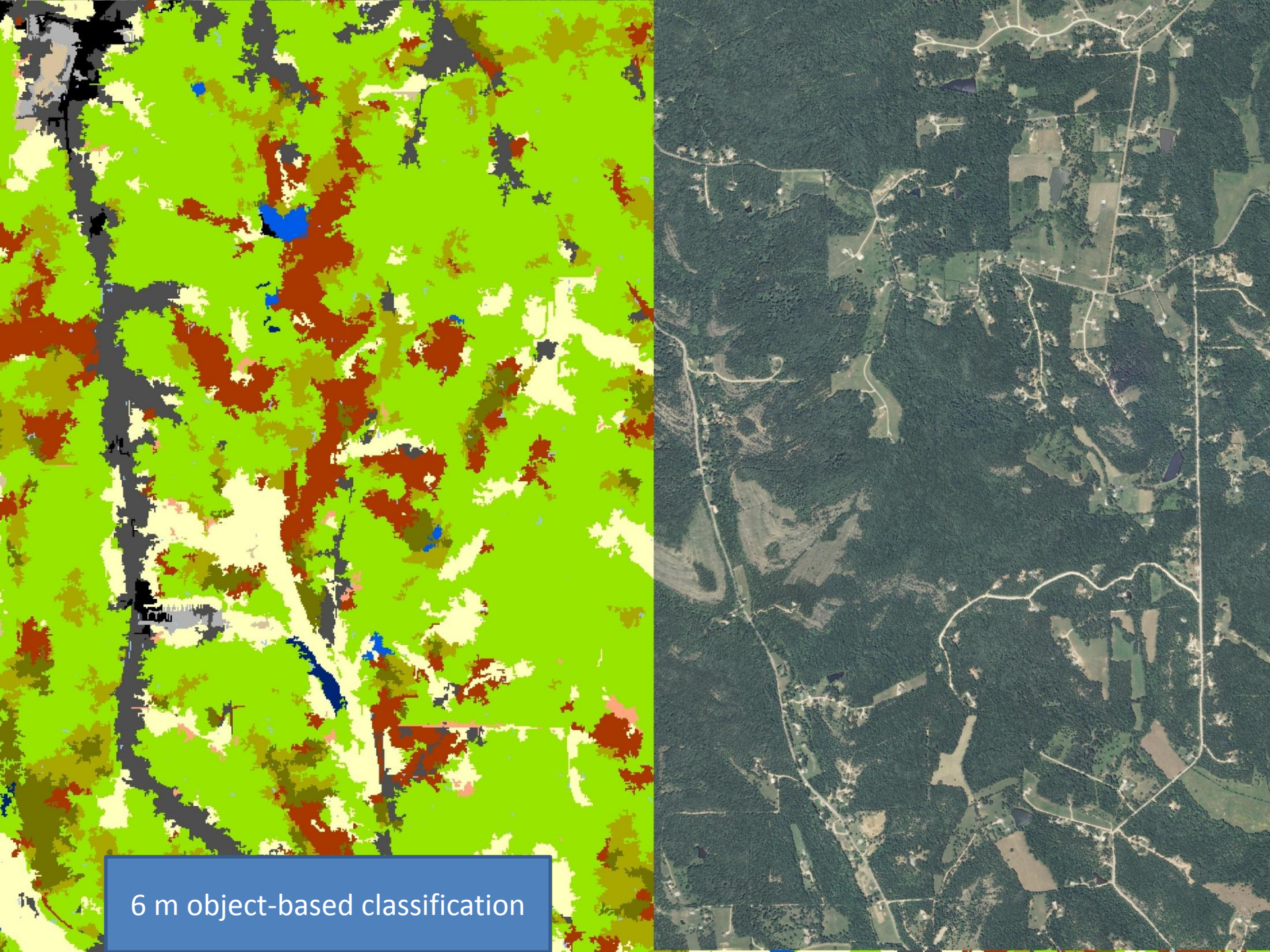
Final Mapped Current Vegetation Types
(60 classes)

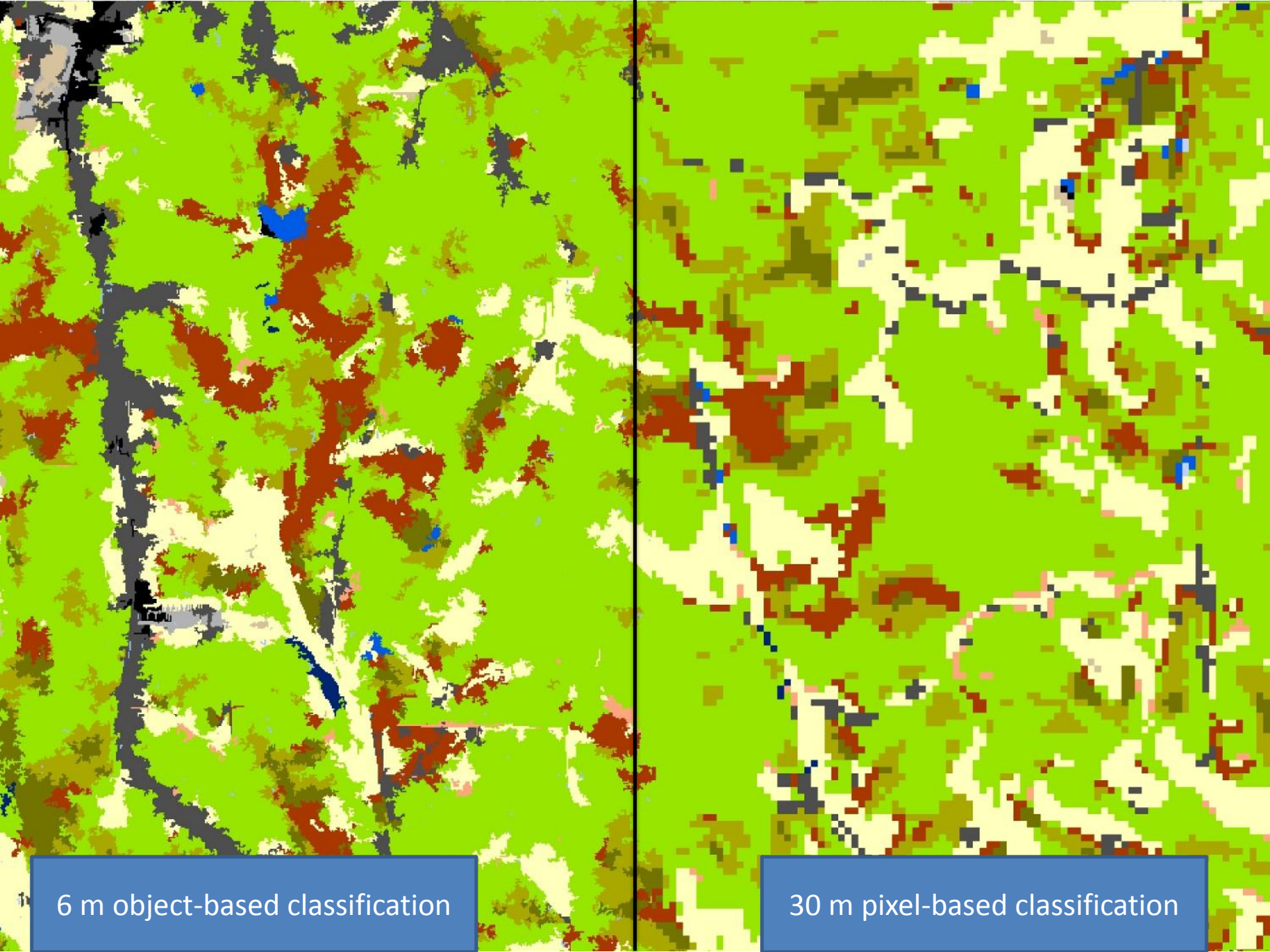
Remote Sensing Product from Decision Tree Classification using Primarily Photo-based Training

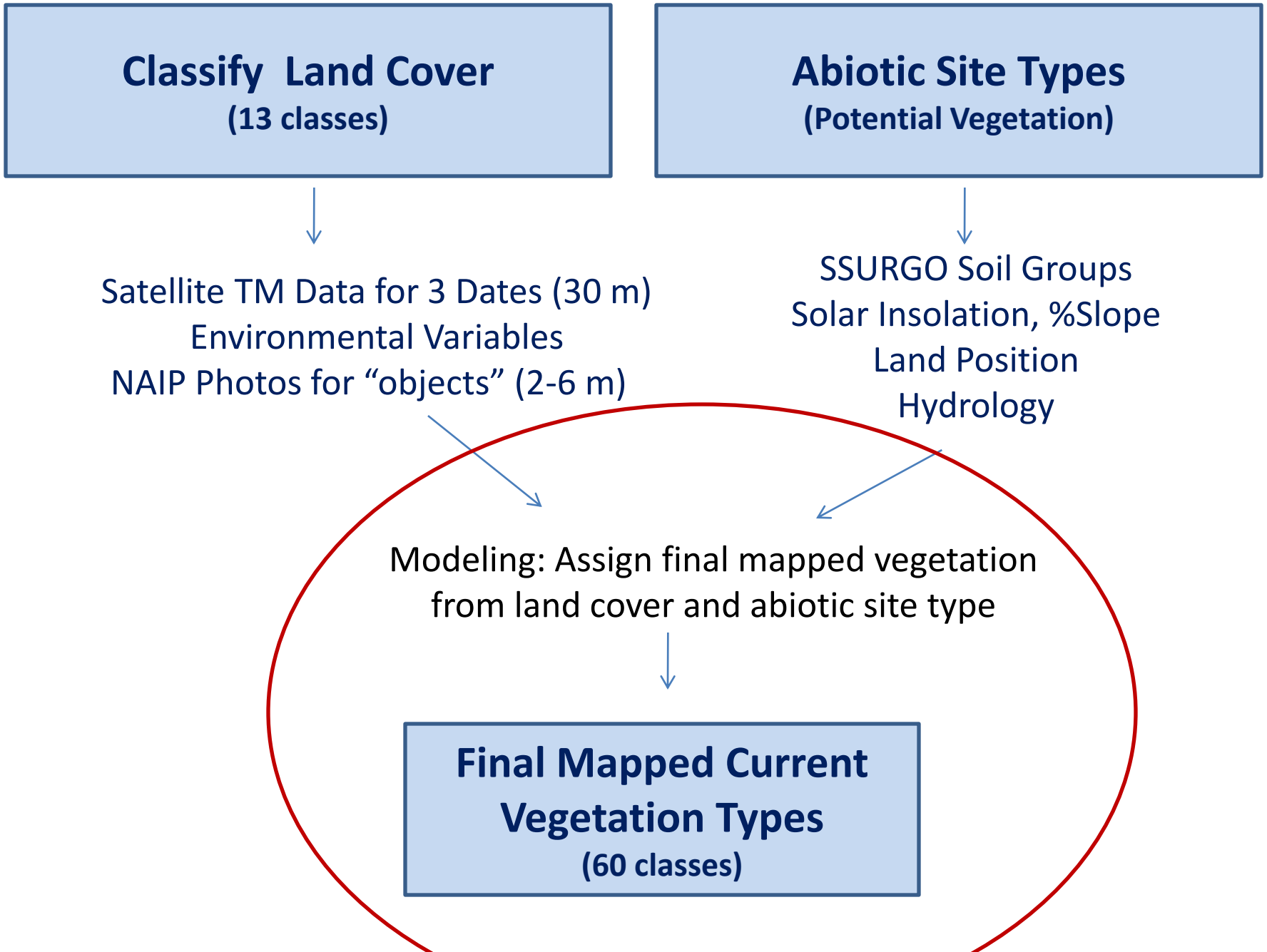
Remote Sensing Product will be from Decision Tree Classification using Primarily Photo-based Training

30 m pixel-based classification

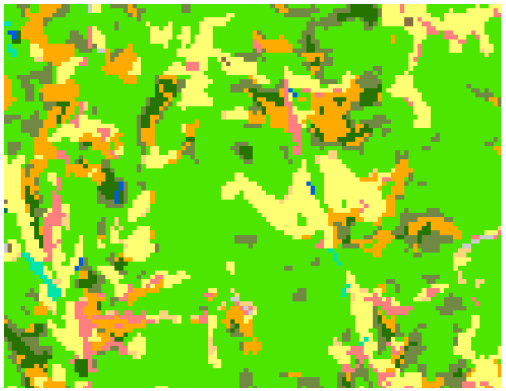

Generating 6 m Image Objects


6 m object-based classification

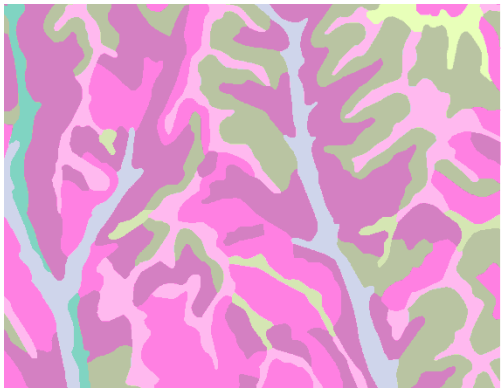

6 m object-based classification
30 m pixel-based classification


Classify Land Cover
(13 classes)
Abiotic Site Types
(Potential Vegetation)
Satellite TM Data for 3 Dates (30 m)
Environmental Variables
NAIP Photos for "objects" (2-6 m)
SSURGO Soil Groups
Solar Insolation, %Slope
Land Position
Hydrology
Modeling: Assign final mapped vegetation from land cover and abiotic site type
Final Mapped Current Vegetation Types
(60 classes)

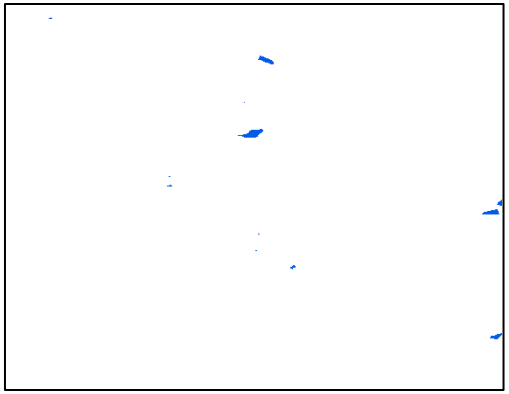
Land Cover and Ancillary Data Applied to Image Objects to Map 60 Current Vegetation Types



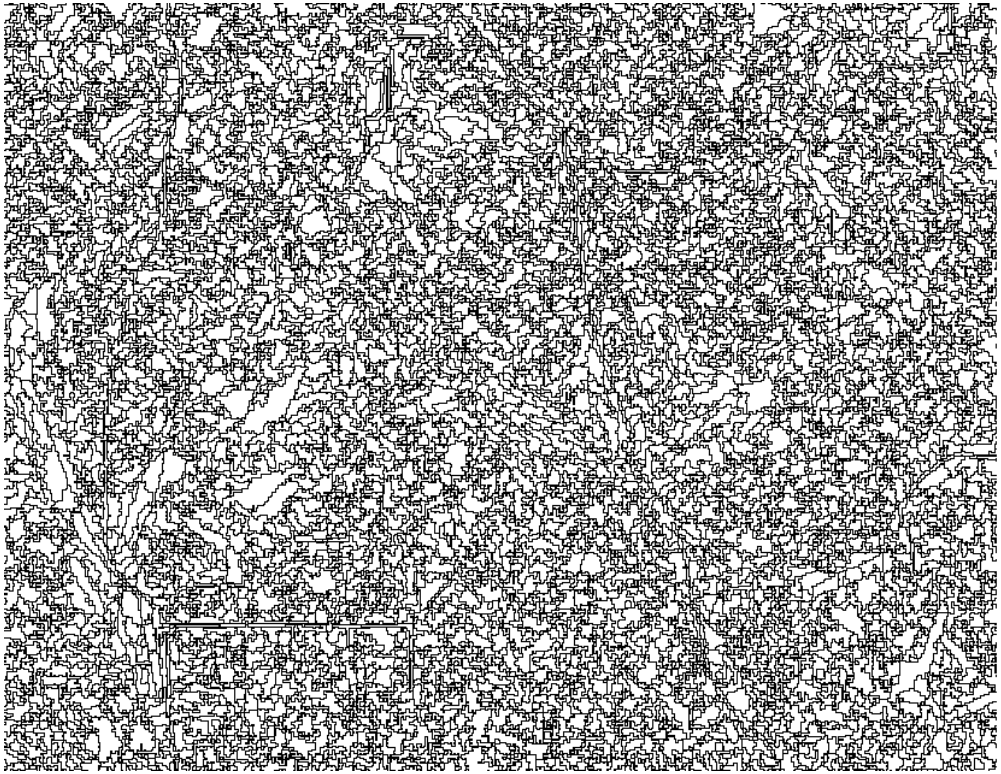
Land Cover



ELT's

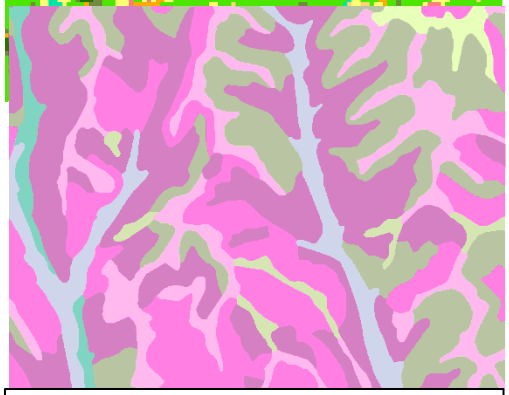


"Wettest" Areas



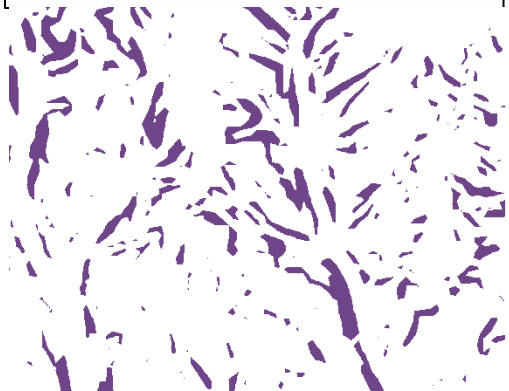
Land Cover and Ancillary Data is Applied to Objects in Illinois

Land Cover

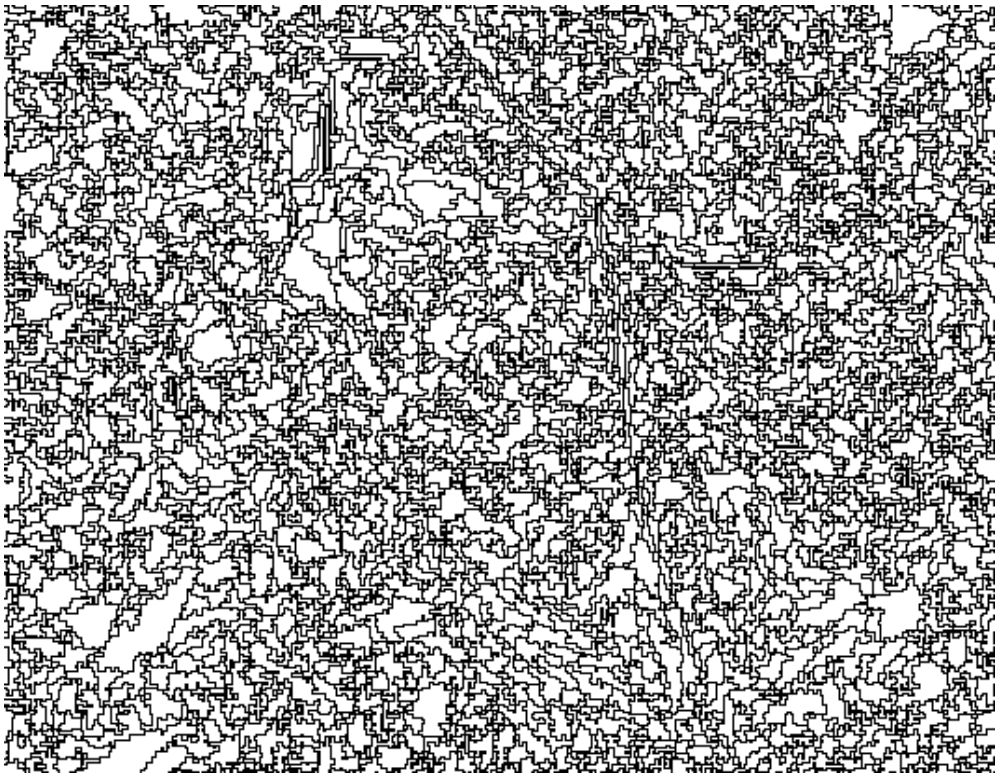


Soils

"Wettest" Areas



Steep Slopes



Current Vegetation Classes for Victoria Glades Area:

-13 land cover types

-60 current mapped vegetation types

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

Table 1. Current vegetation of the East-West Gateway region based on community concepts. Disturbance and successional species are often more common in the modern landscape than indicated by these descriptions. Community importance is ranked from least (1) to most (9) important. See Appendix 1 for detailed descriptions of more natural types.

Current Vegetation	Area (ha)	Comm Import	Brief Conceptual Description	Ecological System
Barren or Sparsely Vegetated	3,635	1	Areas where little or no vegetation existed at the time of image data collection.	N/A
Bottomland Forest: Mixed Bottomland Hardwood Forest	7,135	9	Forests dominated by bottomland hardwoods including *Quercus macrocarpa* (bur oak), *Ulmus* spp. (elms), *Celtis* spp. (hackberries), *Fraxinus* spp. (ashes), and *Salix nigra* (black willow), along with *Juniperus virginiana* (eastern red cedar).	North-Central Interior Floodplain
Bottomland Forest: Pin Oak/Bur Oak-Swamp White Oak/Pecan Forest	5,504	9	Forests generally occupying relatively level sites that are temporarily or seasonally flooded and dominated by species such as *Quercus palustris* (pin oak), *Quercus macrocarpa* (bur oak), *Quercus bicolor* (swamp white oak), and *Carya illinoinensis* (pecan). Other canopy species may include *Ulmus rubra* (slippery elm), *Fraxinus pennsylvanica* (green ash), and *Celtis laevigata* (hackberry). A woody and herbaceous understory may be well-developed with species such as *Carpinus caroliniana* (American hornbeam) and vines including *Toxicodendron radicans* (poison ivy).	North-Central Interior Floodplain
Bottomland Forest: Sycamore, Cottonwood, Elm, Ash Hackberry Riverfront Forest	7,615	9	Forests occupying sites directly adjacent to riverfront and on first levees and successional terraces. These forests are dominated by species such as *Platanus occidentalis* (American sycamore), *Populus deltoides* (eastern cottonwood), *Fraxinus pennsylvanica* (green ash), *Acer saccharinum* (silver maple), *Celtis* (hackberries), *Ulmus* (elms), *Betula nigra* (river birch), *Salix nigra* (black willow), and *Acer negundo* (boxelder). Sites experience frequent flooding and understory vegetation is typically not well-developed.	North-Central Interior Floodplain
Bottomland Forest: White Oak/Red Oak-Dogwood/Sycamore Forest	1,319	9	Forests occupying less frequently flooded sites on slight rises such as elevated terraces and upper drainages. These forests are often dominated by mesic forest species such as *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Platanus occidentalis* (American sycamore). Other common canopy components include *Carya cordiformis* (bitternut hickory), *Juglans nigra* (black walnut), *Ulmus rubra* (slippery elm), and *Quercus macrocarpa* (bur oak). Understory may be patchy with species including *Carpinus caroliniana* (American hornbeam), *Corylus americana* (American hazelnut), and *Lindera benzoin* (spicebush).	North-Central Interior Dry-Mesic Oak Forest and Woodland
Bottomland: Disturbance Grassland	57,126	5	Sites on bottomland soils where woody overstory is lacking. These sites are often occupied by managed grasslands.	N/A
Bottomland: Herbaceous-dominated Wetland	13,620	9	Marshes and herbaceous wetlands on bottomland sites often dominated by sedges, *Typha* spp. (cattails), and other wetland species.	Eastern Great Plains Wet Meadow, Prairie, and Marsh

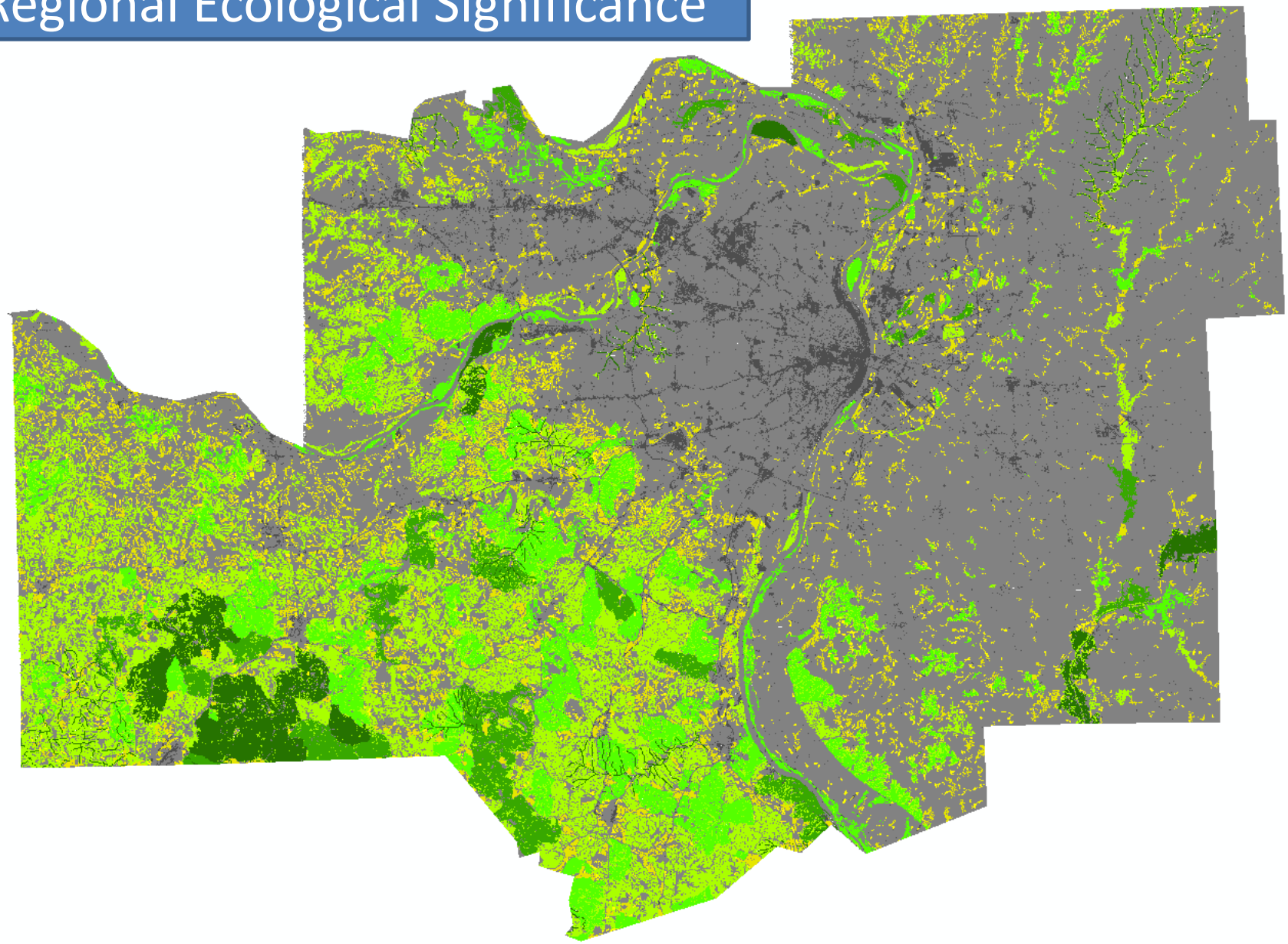
Ranking at Multiple Scales

- Guiding Principles
  - Coarse filter/fine filter
  - Landscape context & viability
- Basic Method: Attributes attached to patches
- Multiple Resolutions
  - Regional analysis emphasizes landscape context
  - Project-level emphasizes community importance
  - Special consideration for wetland mitigation and restoration

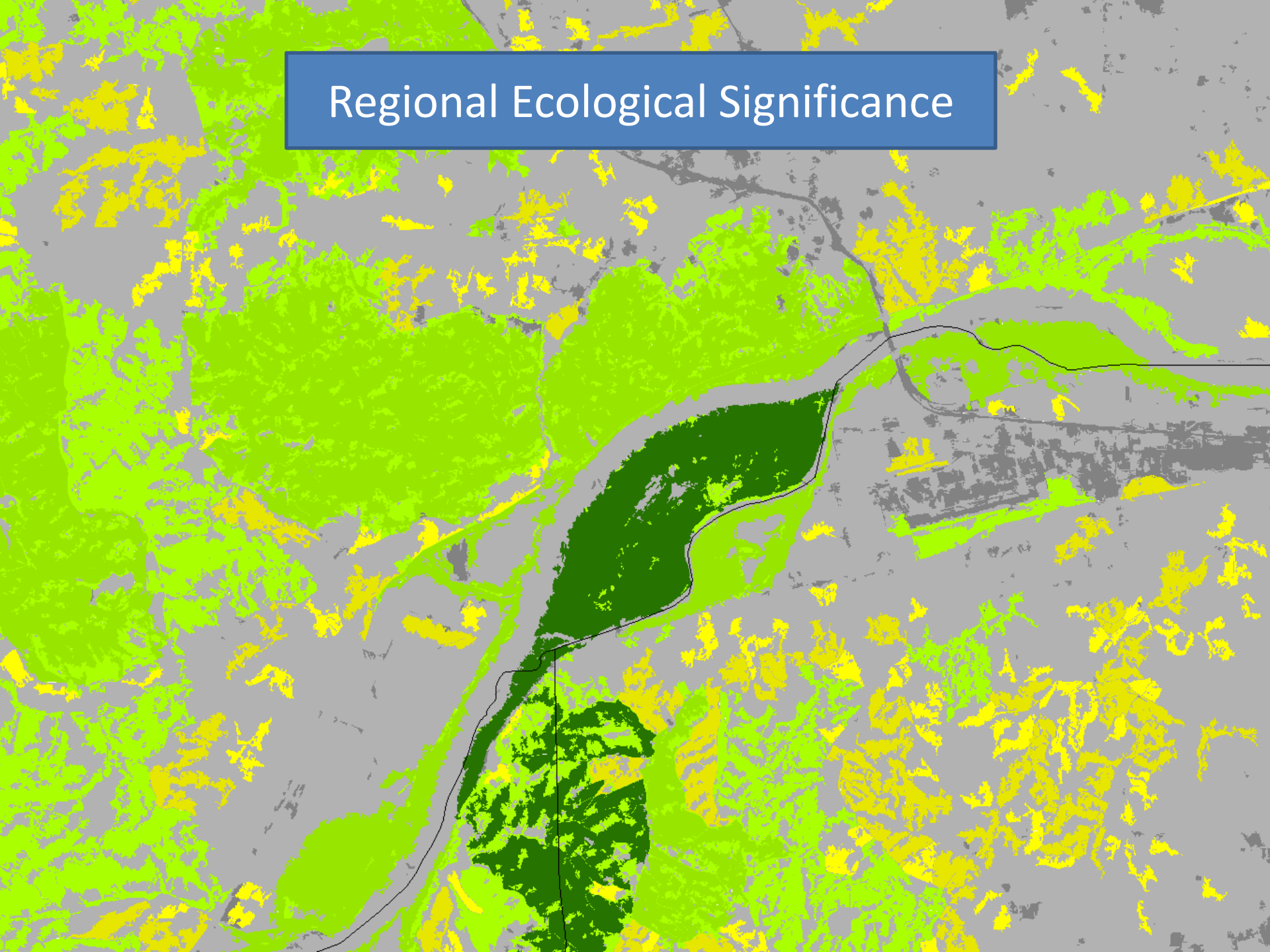
Ranking Algorithms

- Regional: attributes by natural & semi-natural vegetation patches
  - Patch size, community type composition, rare species occurrence, public lands, GAP predicted species diversity
- Project-level: attributes by community type patches
  - Community type importance, regional significance, rare species, public lands, roads
- Wetlands – similar to project-level attributes for significance; croplands ranked for restoration priority

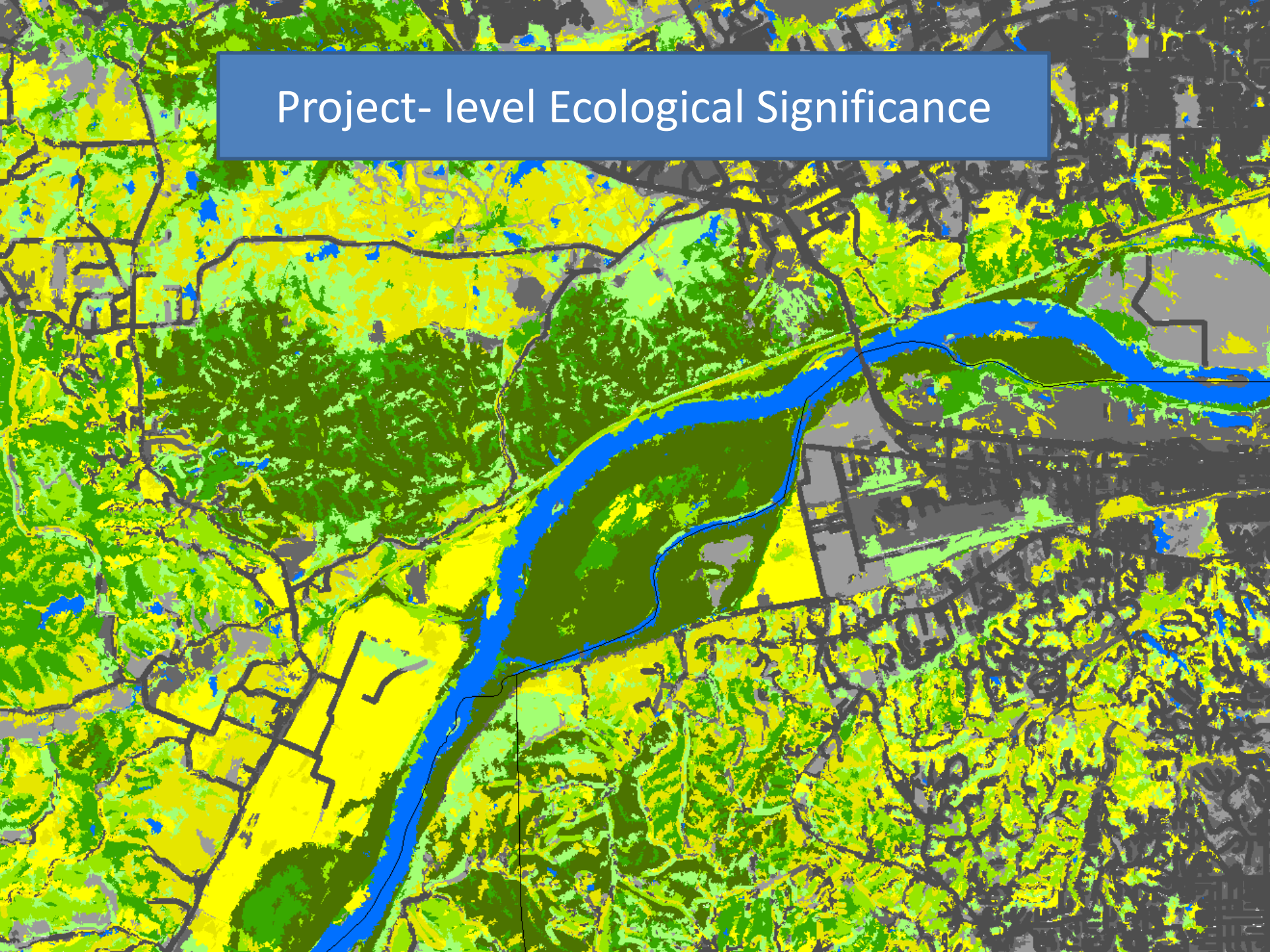
Regional Ecological Significance



Regional Ecological Significance

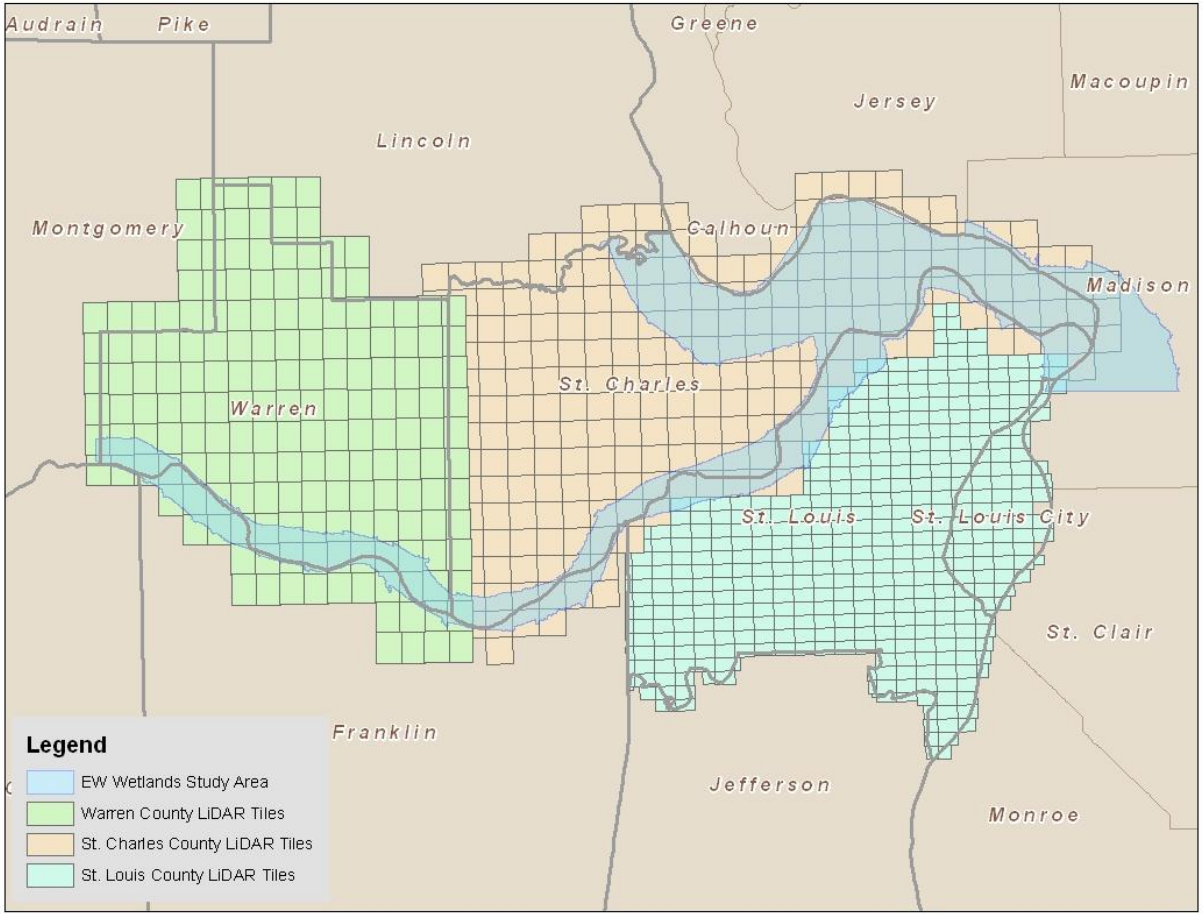


Project- level Ecological Significance



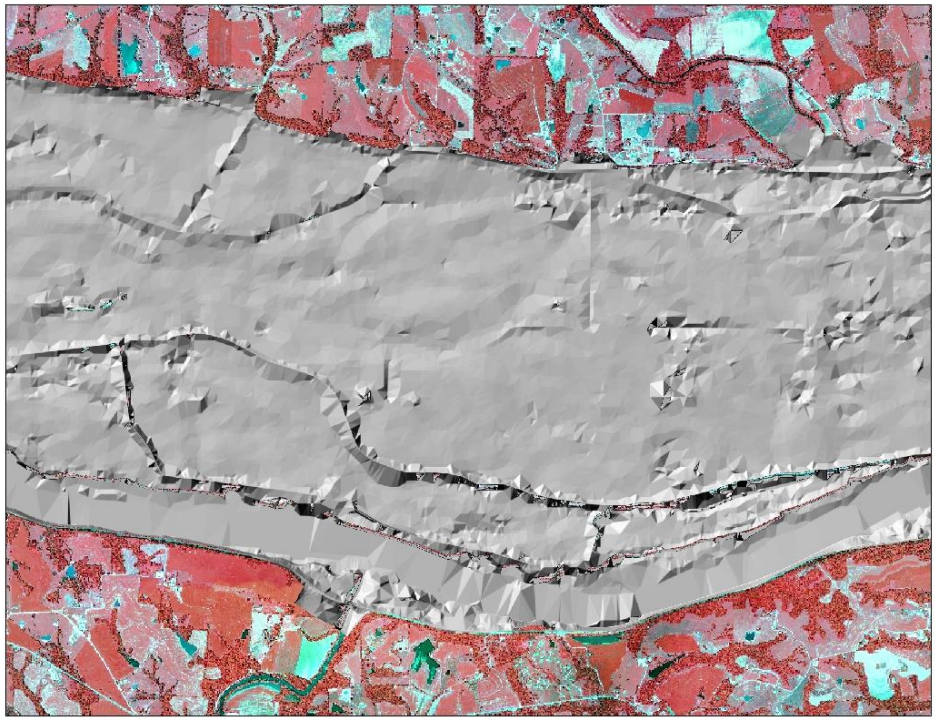
LiDAR Data Acquisition for East-West Gateway Wetlands Study Area

- EW Wetlands Study Area
  - Missouri River Floodplain in Warren, Franklin, St. Charles, St. Louis, St. Louis City counties in Missouri
- LiDAR Data used
  - Warren, St. Charles and St. Louis Counties
- Acquired from Washington University
  - http://maps.wustl.edu/mo_lidar_data/
- LAS files = 160 GB for all of the 3 counties and 58 GB for study area

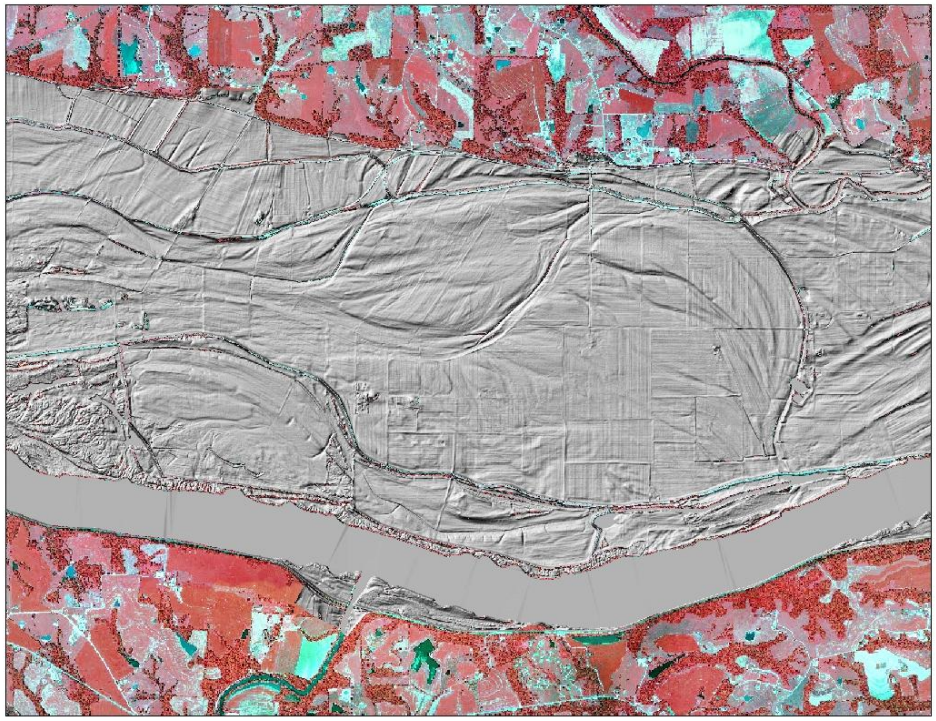


DEM Improvement

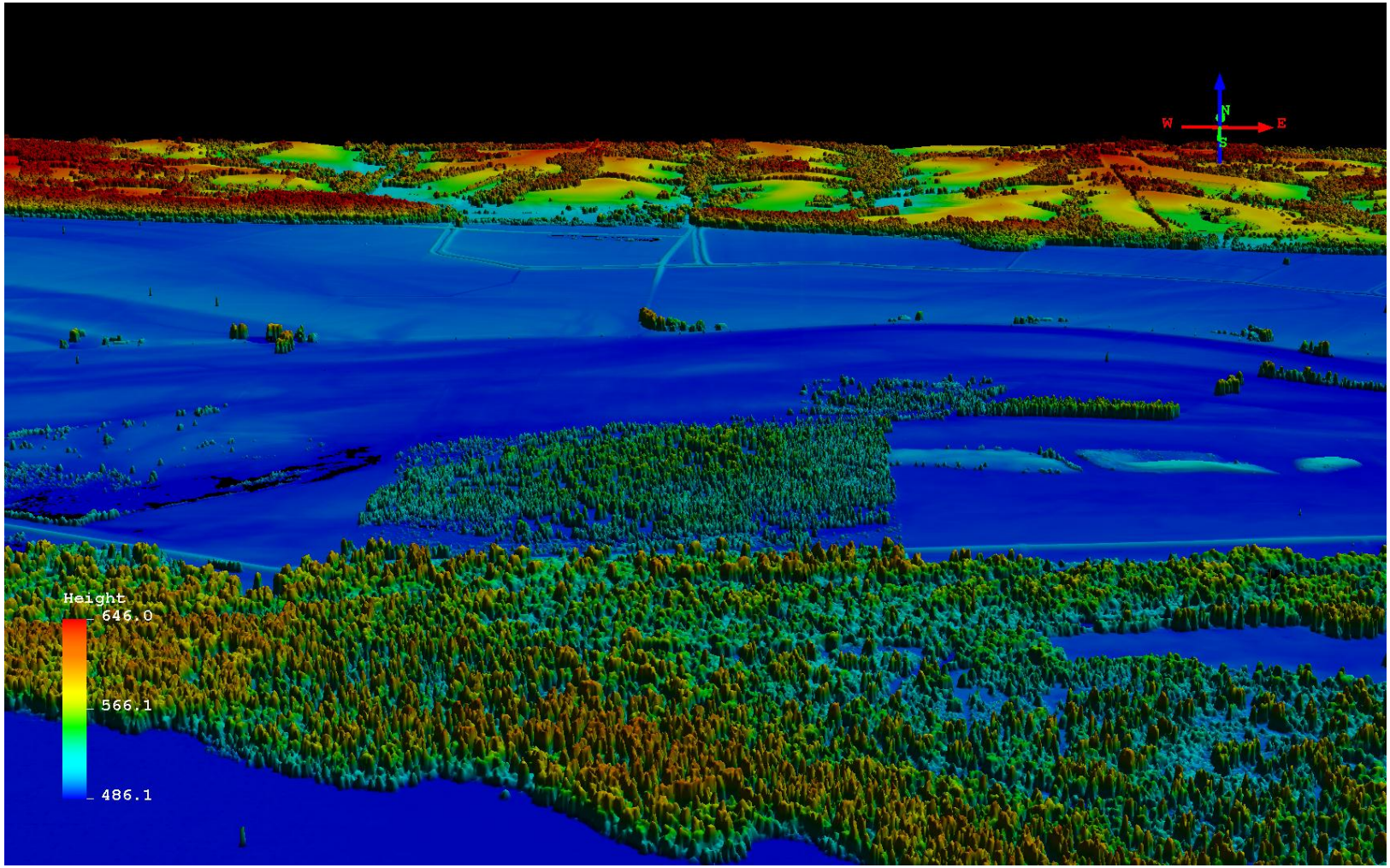
2006 COE 5 meter DEM



2008 – 2010 LiDAR 5 meter DEM

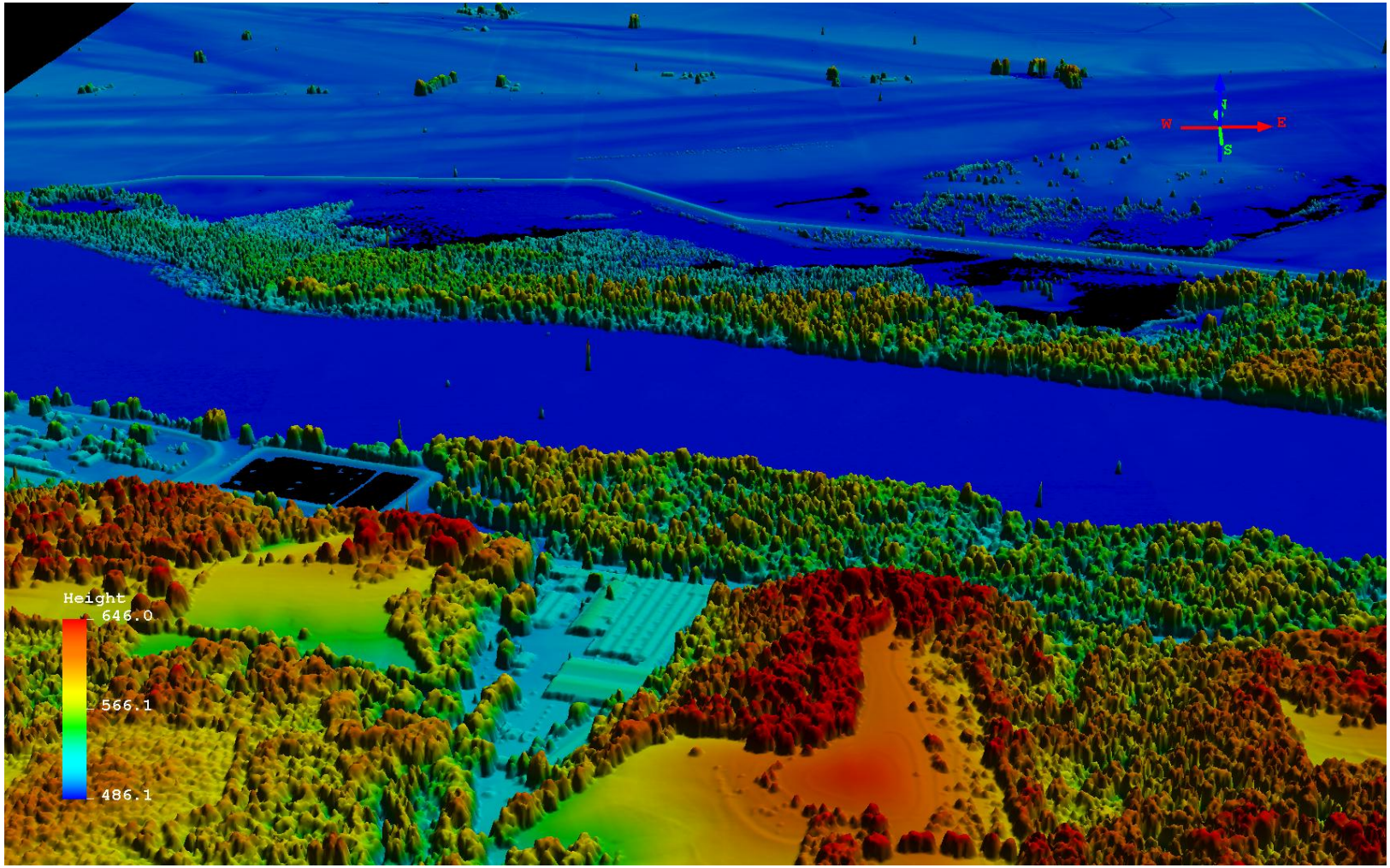


Quick Terrain Modeler Image

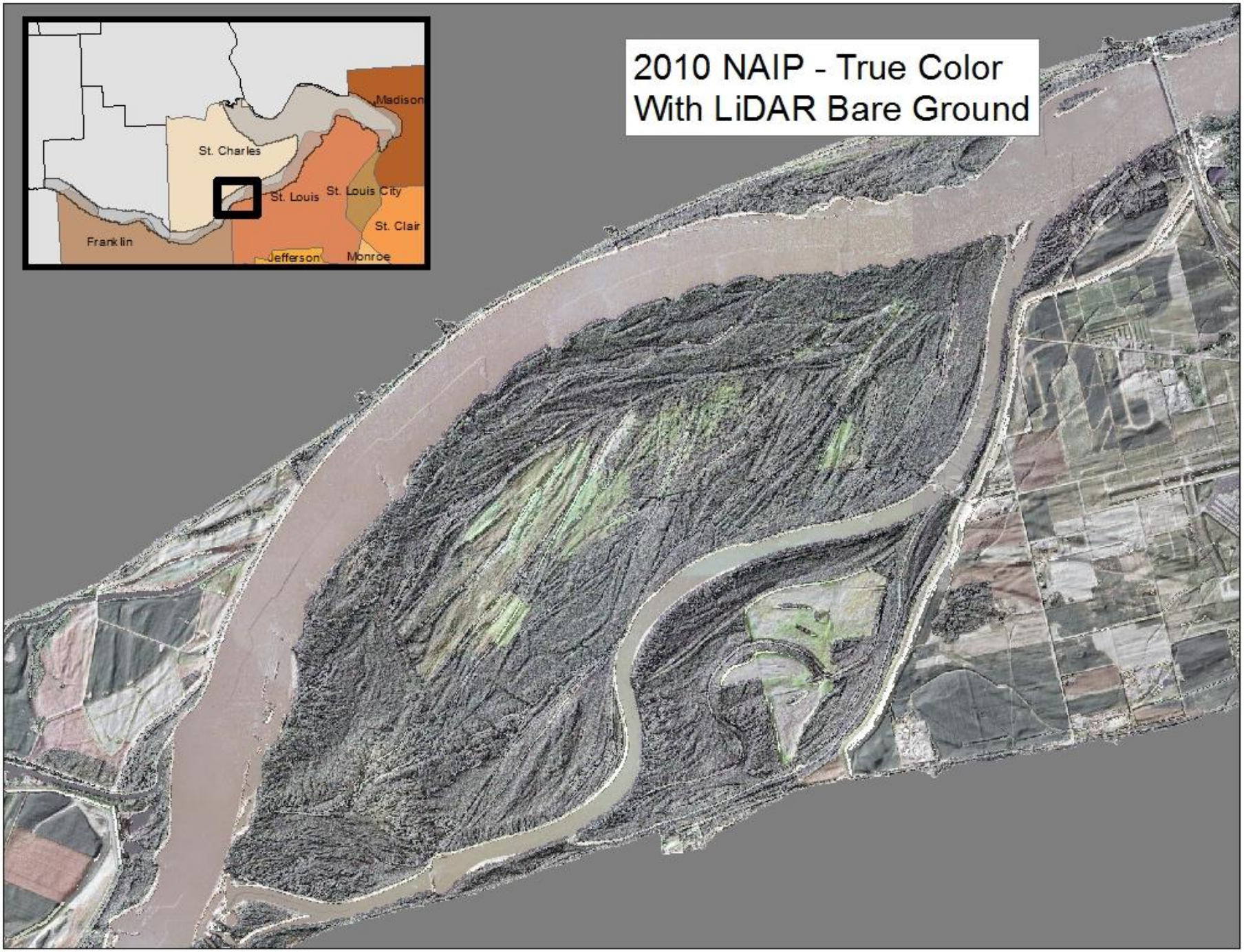


LiDAR DSM Grid Oblique

Quick Terrain Modeler Image

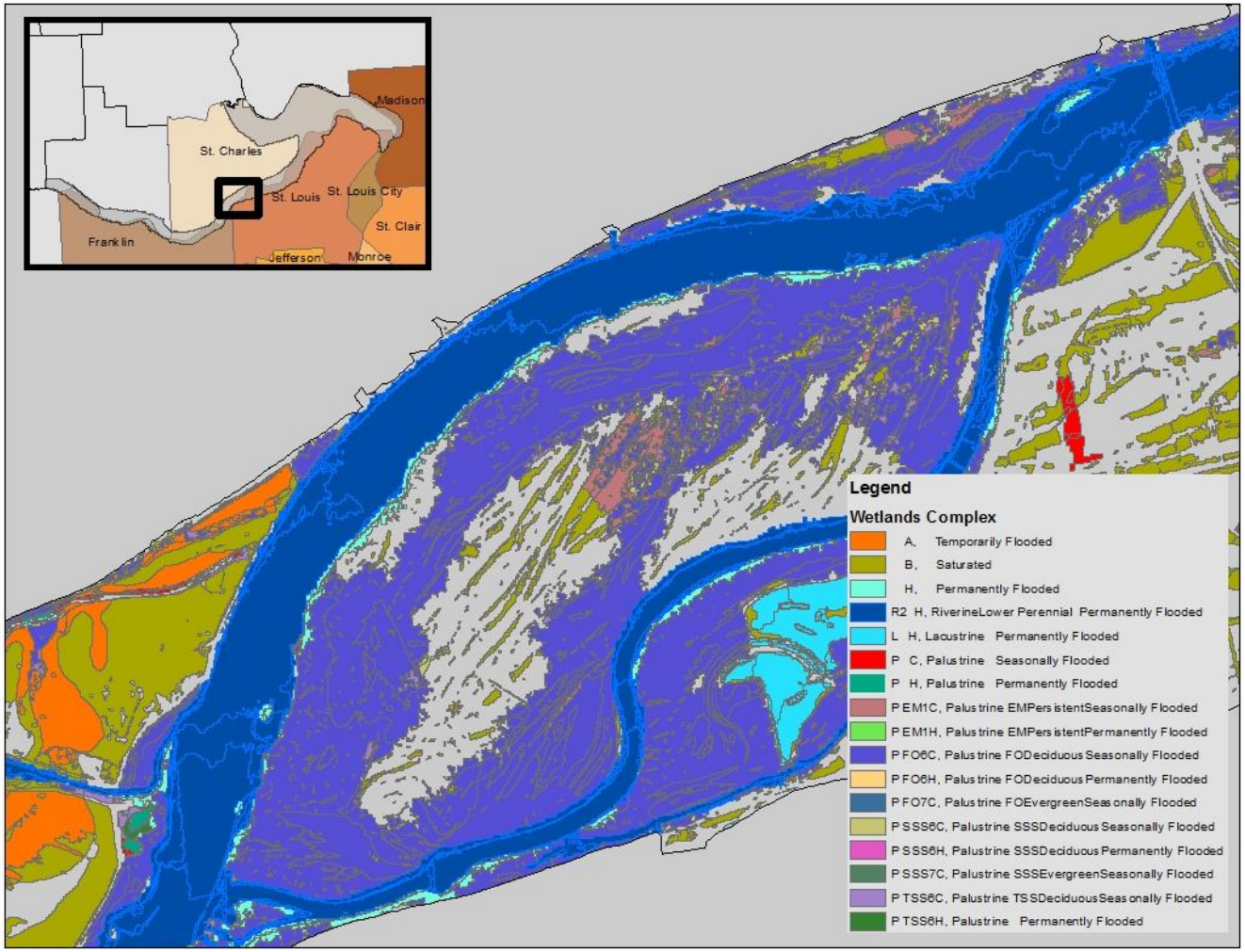


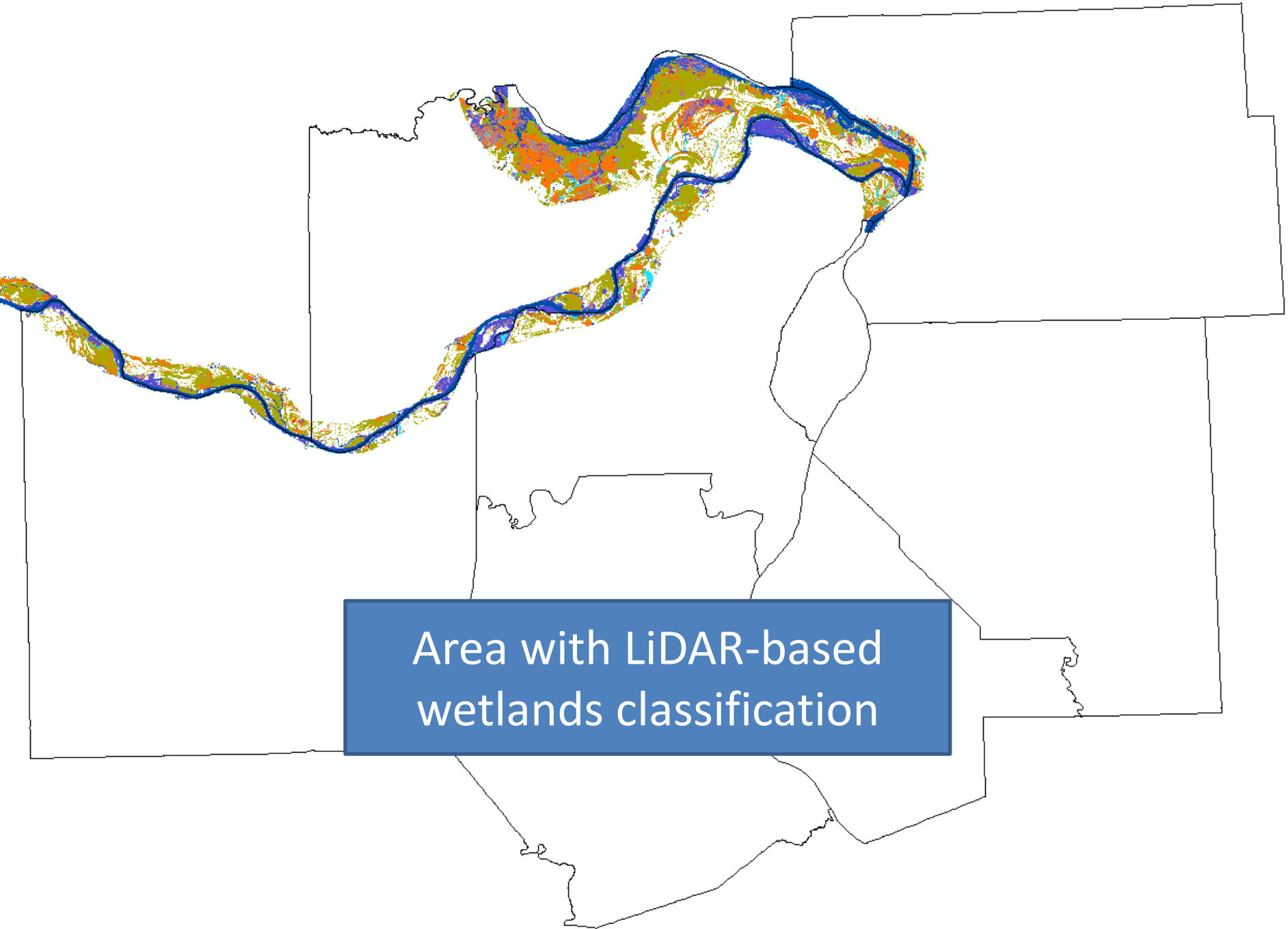
LiDAR DSM Grid Oblique


2010 NAIP - True Color
With LiDAR Bare Ground
Madison
St. Charles
St. Louis
St. Louis City
St. Clair
Franklin
Jefferson
Monroe

Wetland Classification

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




Area with LiDAR-based wetlands classification

Importance =
([size_rank] * 1.5) + [divers_rank] +
[pub_rank] - [urban_rank]

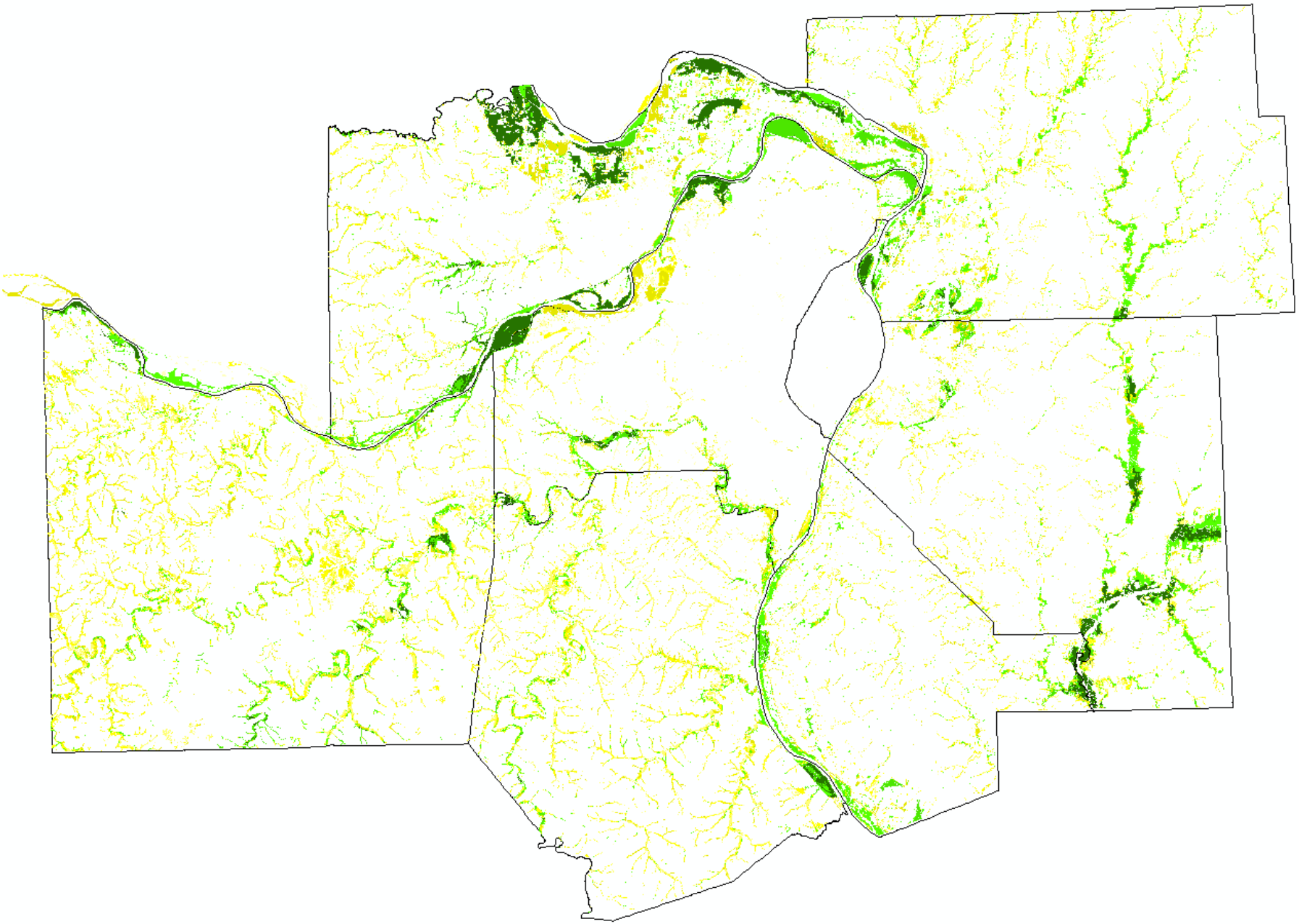
Wetland Complex Importance =

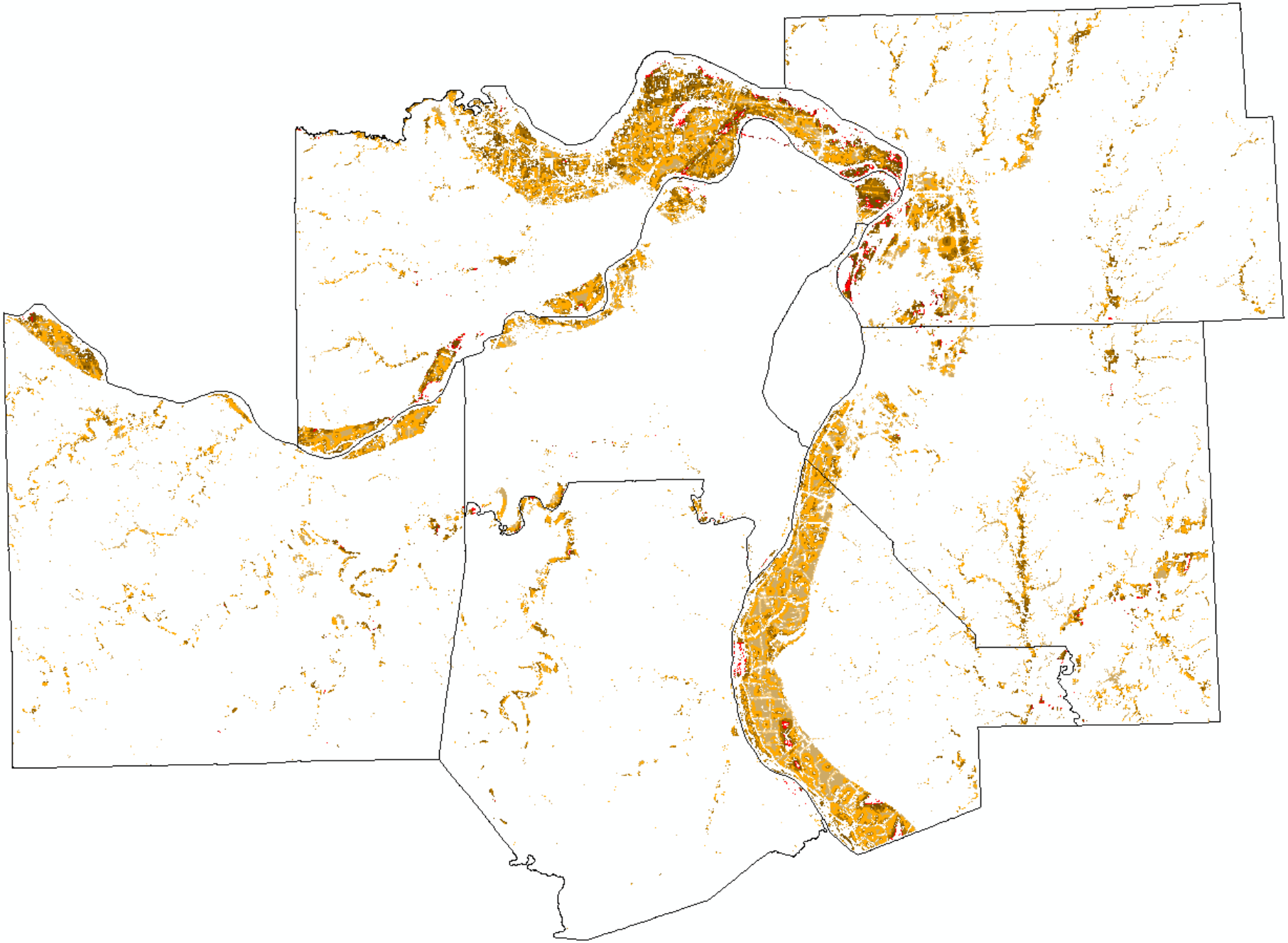
Weighted Patch Size Rank +
Diversity Rank +
Distance to Protected Lands -
Distance to Urban Lands

Restore_rank = "water_reg_abc" + "protect_rank2" - "urban_rank3" + "water_buff2" + "wetland_rank2"

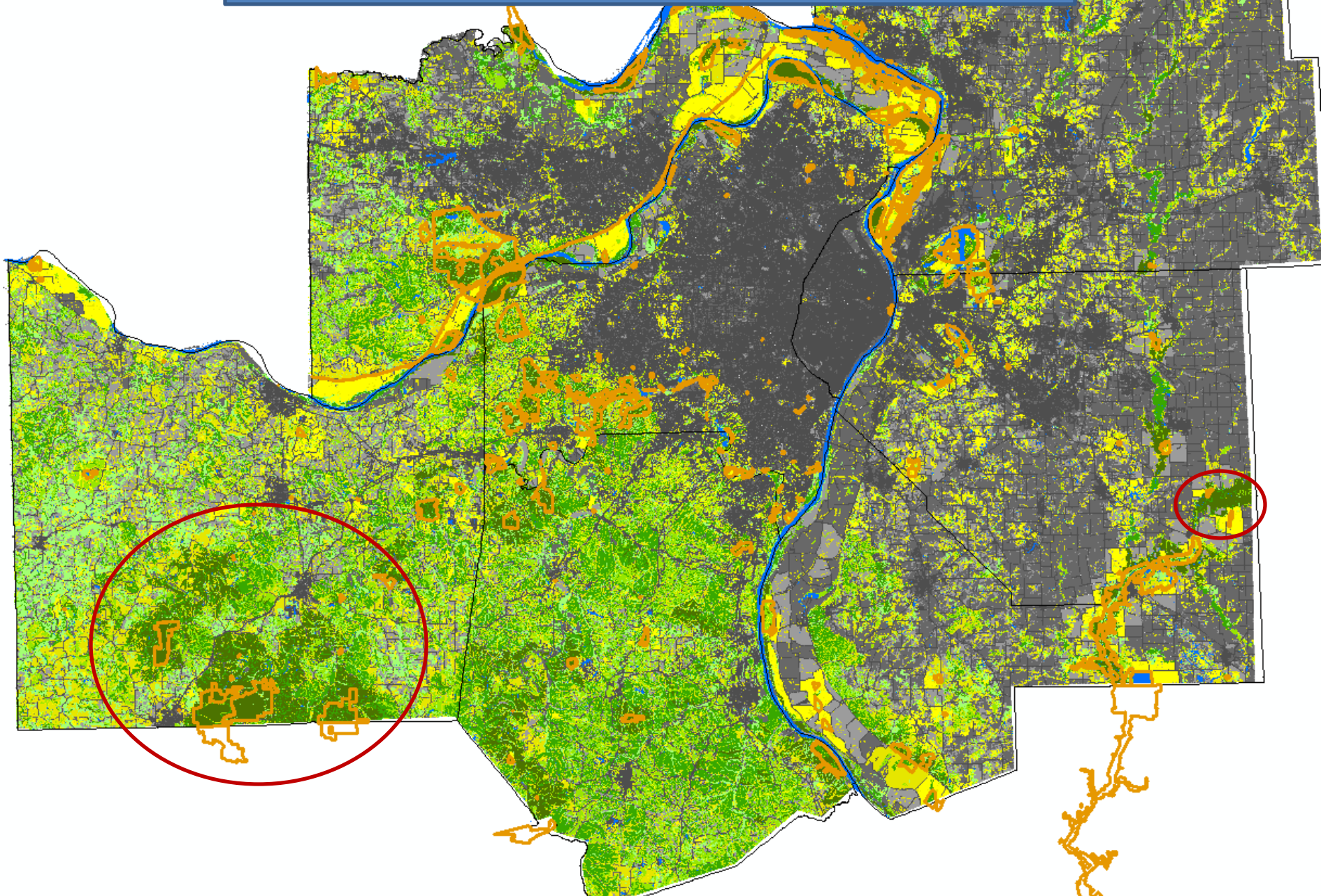
Restoration Rank =

Water Regime Rank +
Distance to Protected Lands –
Distance to Urban Lands +
Distance to Water +
Distance to Existing Wetlands

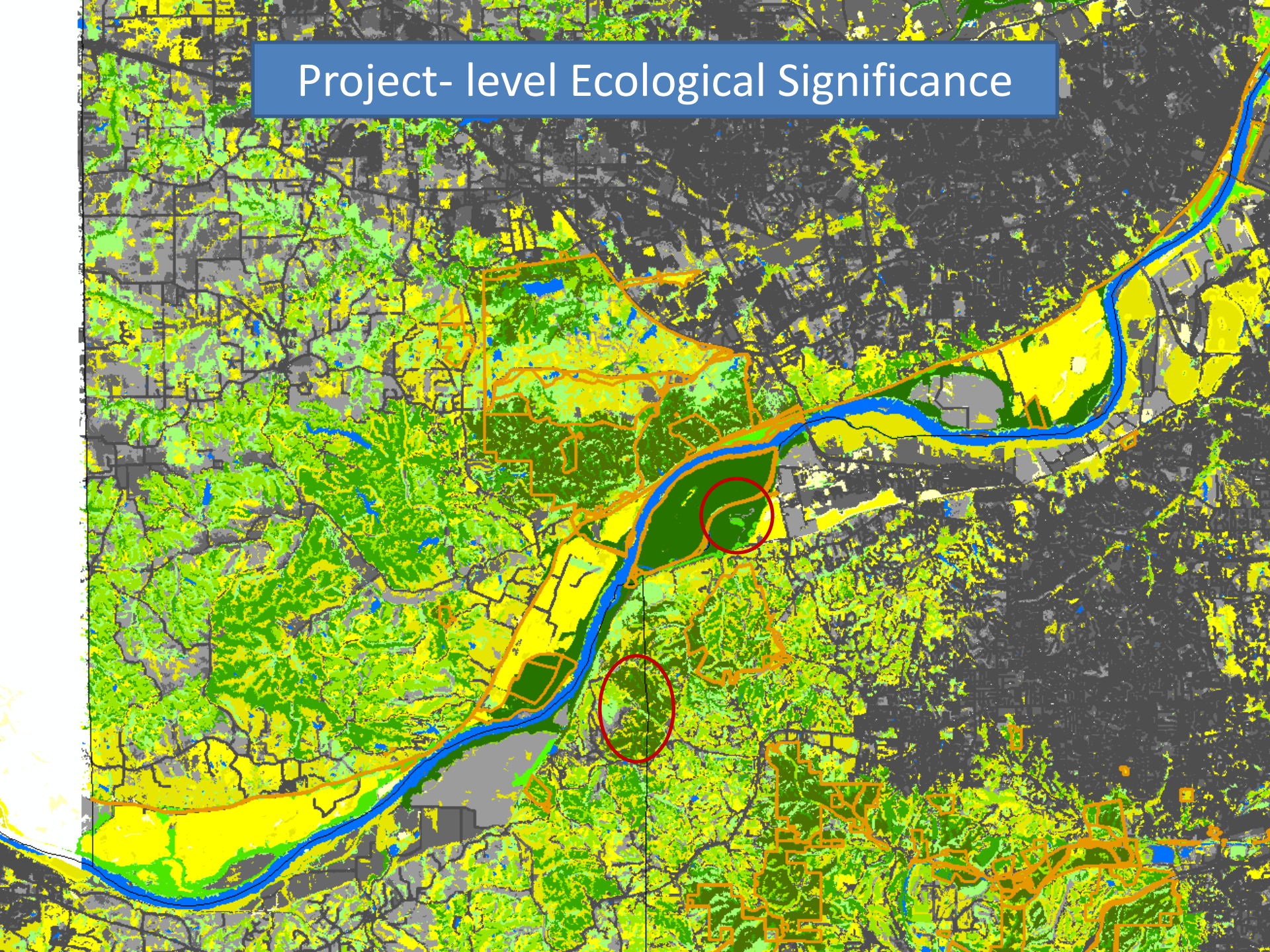




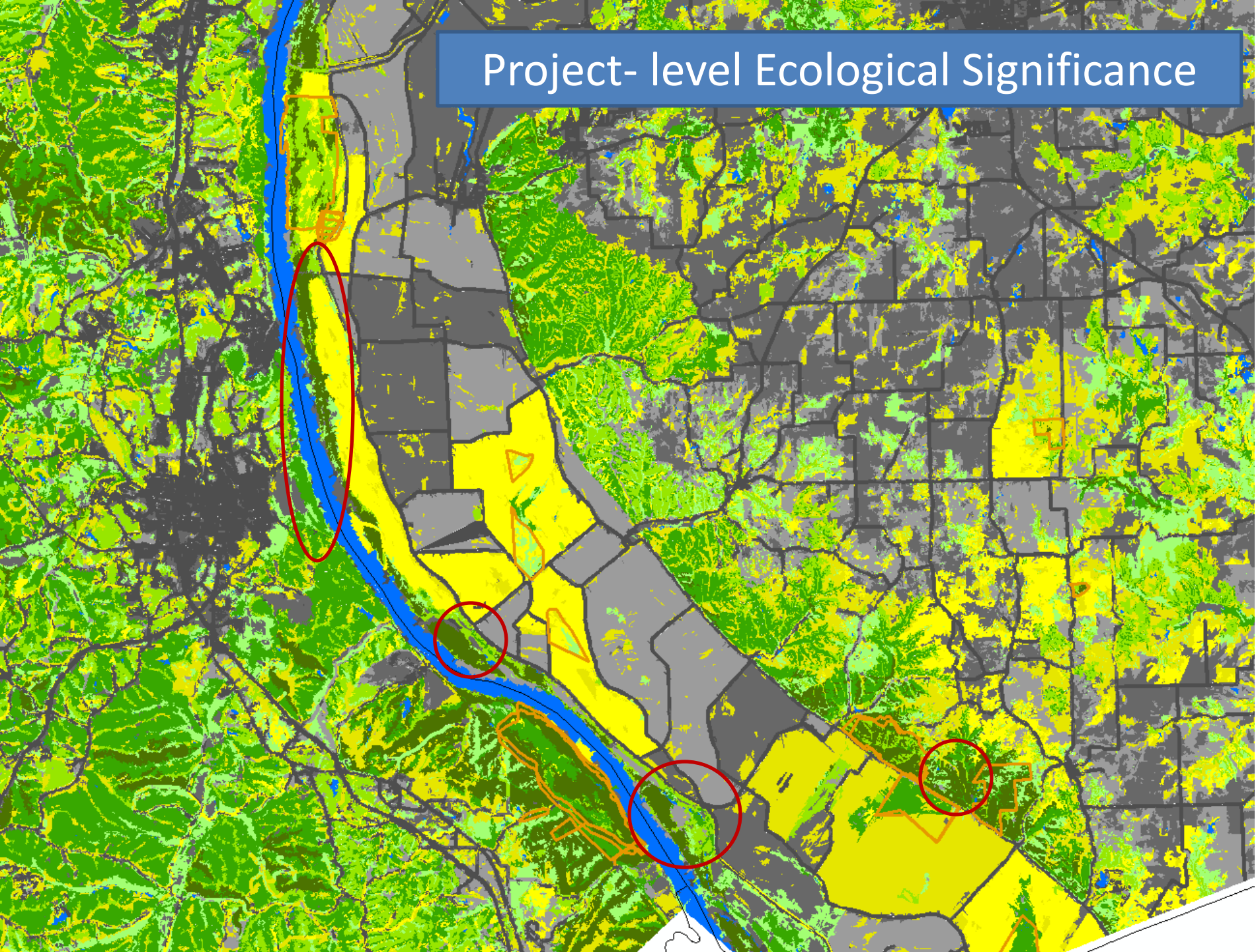
Project- level Ecological Significance



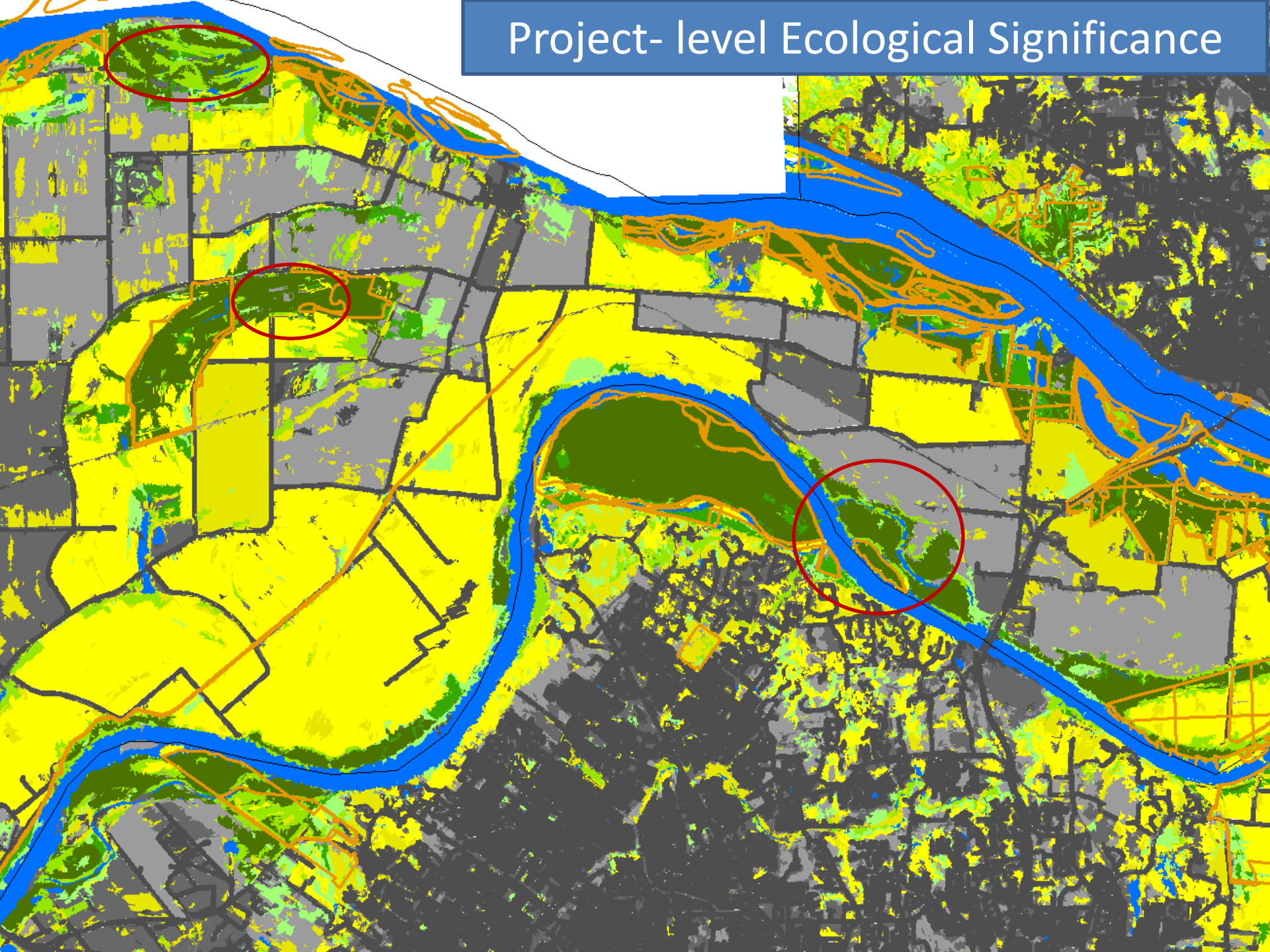
Project- level Ecological Significance

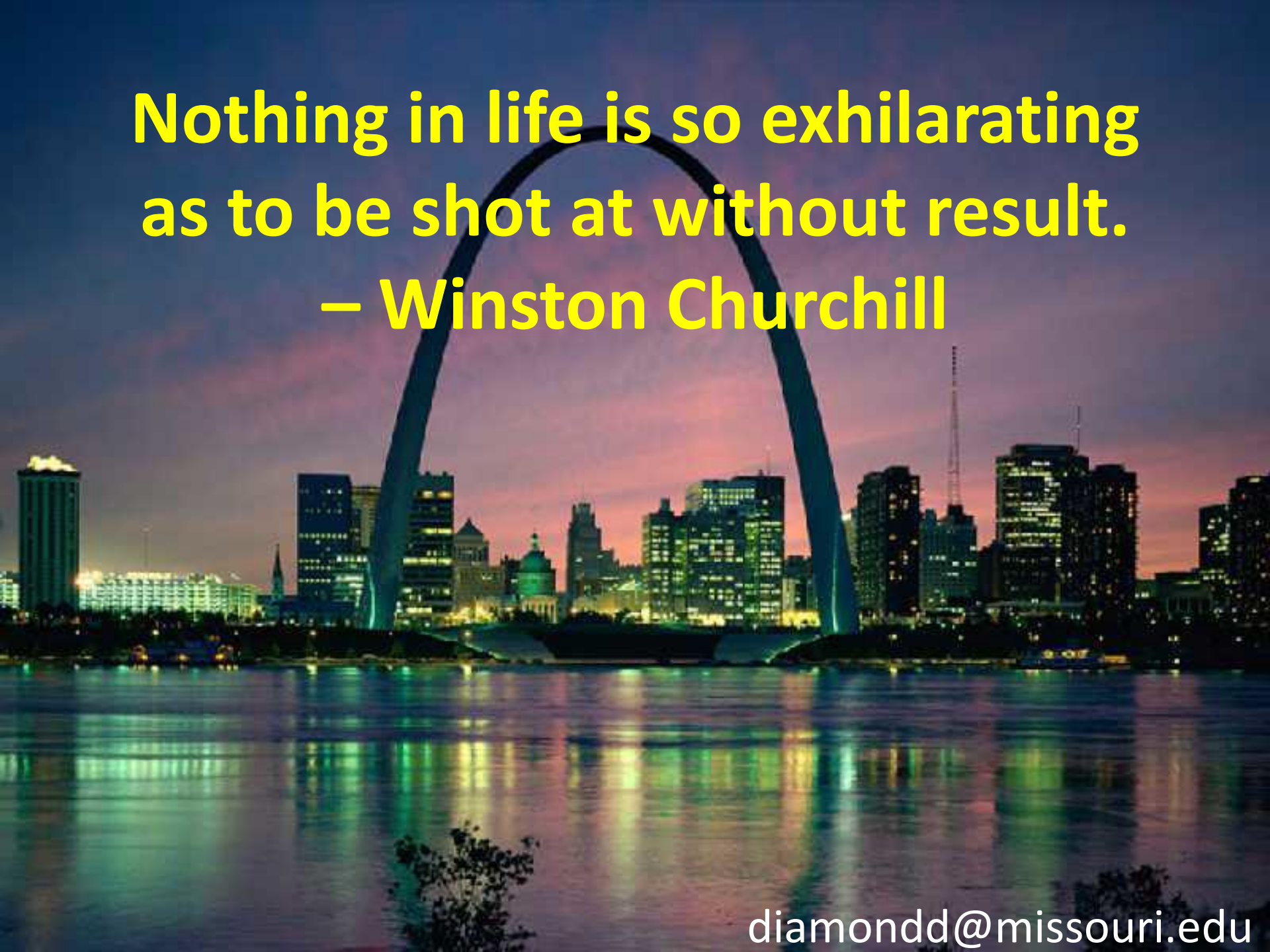


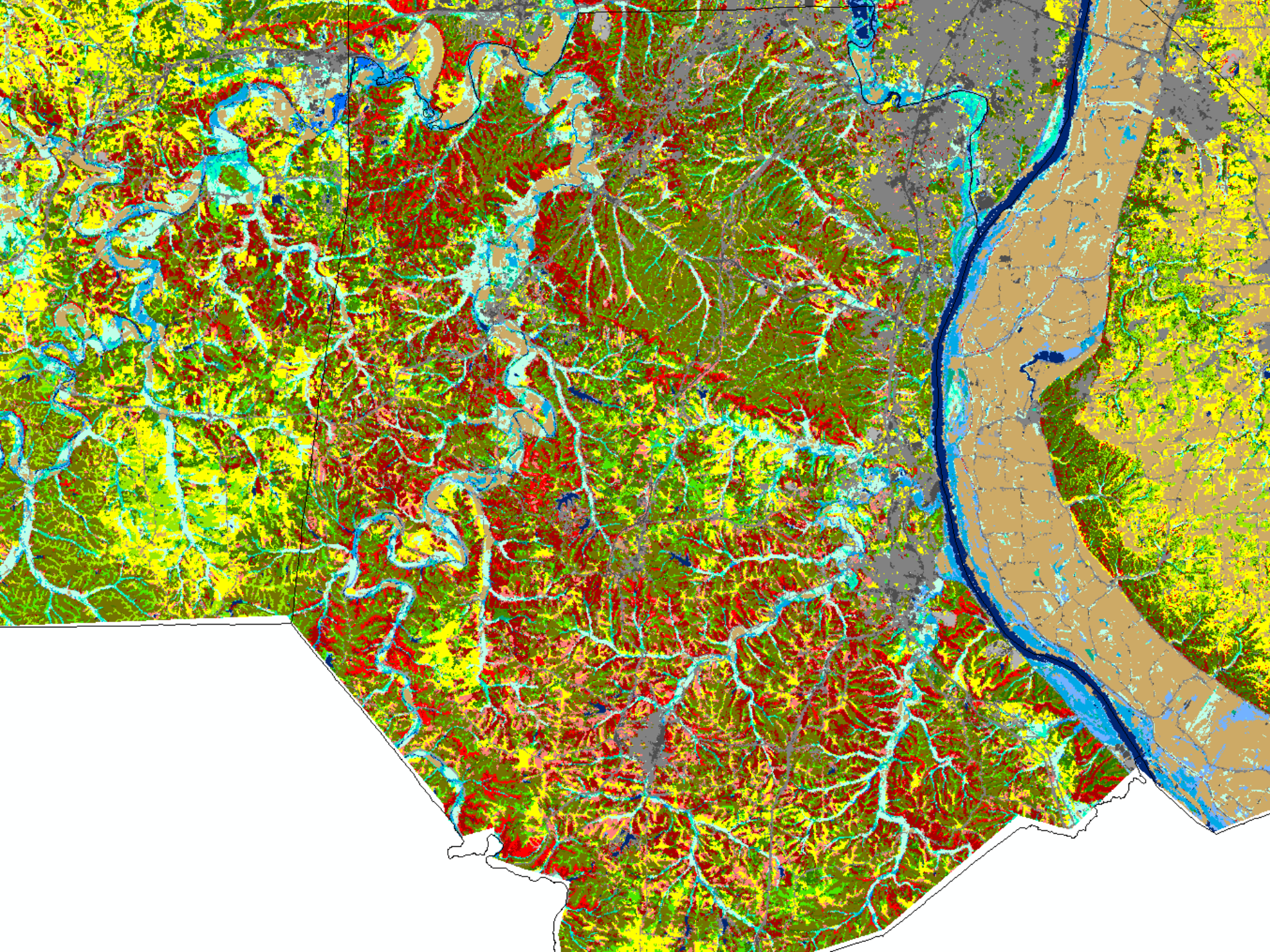
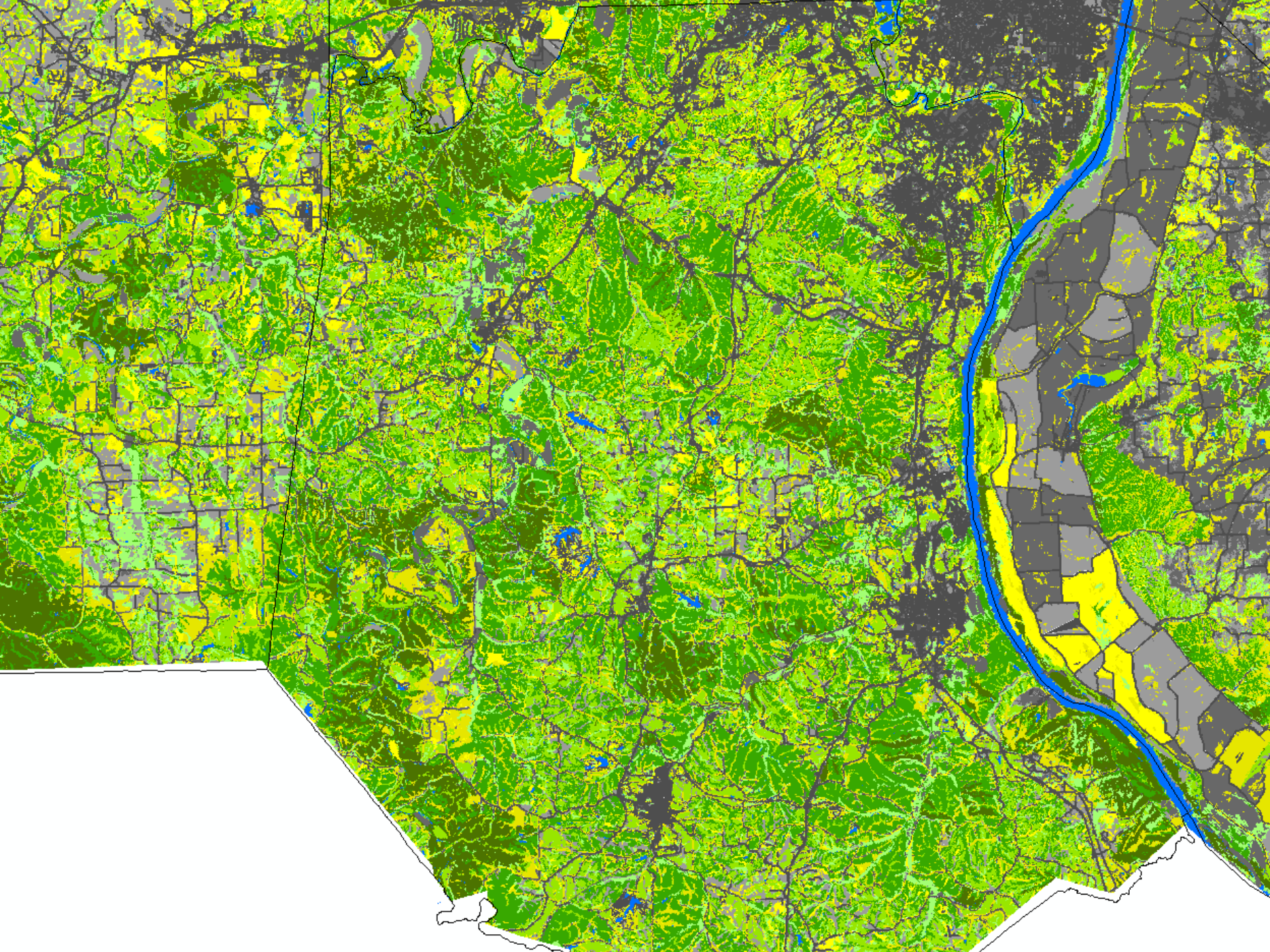
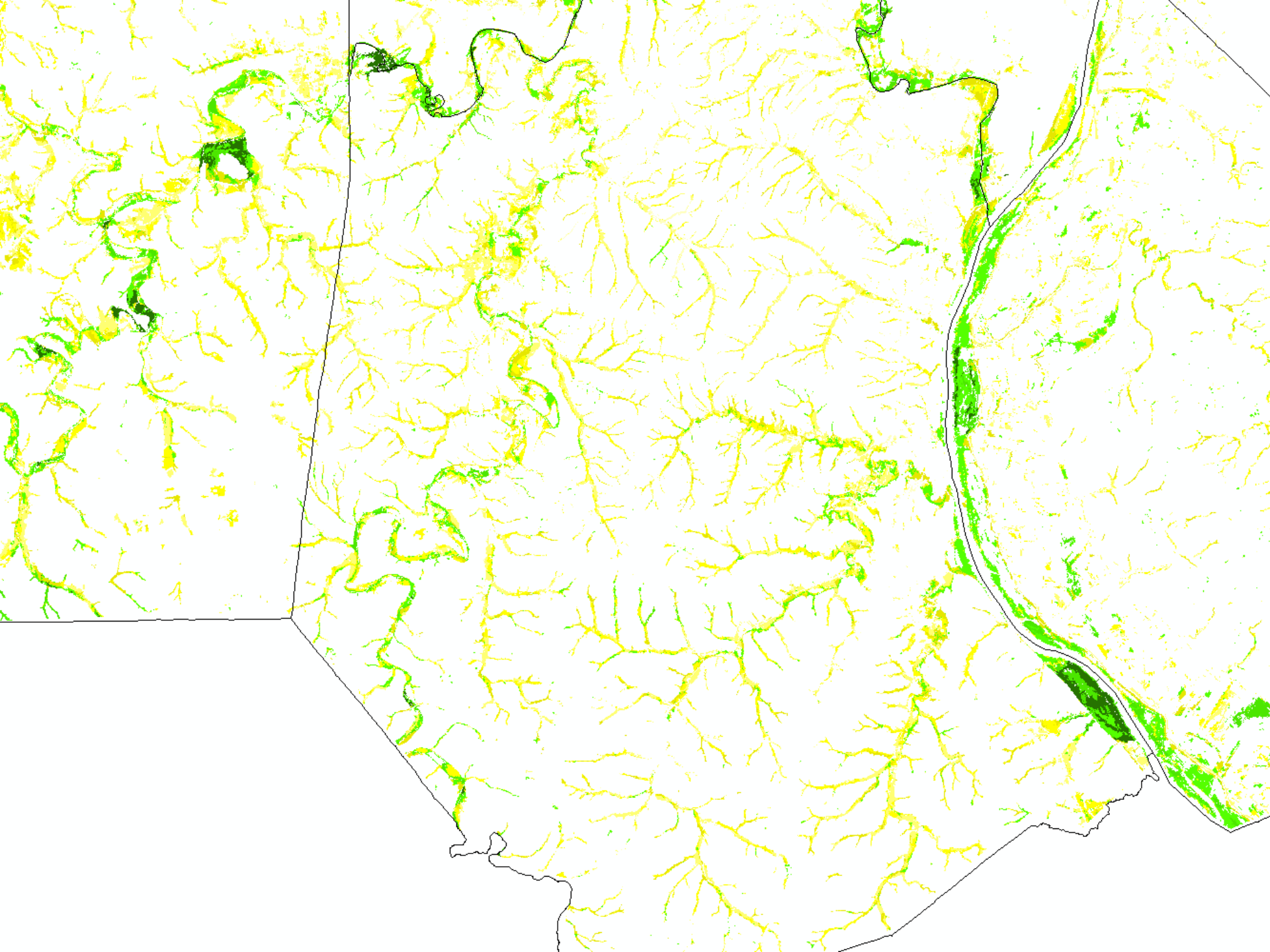
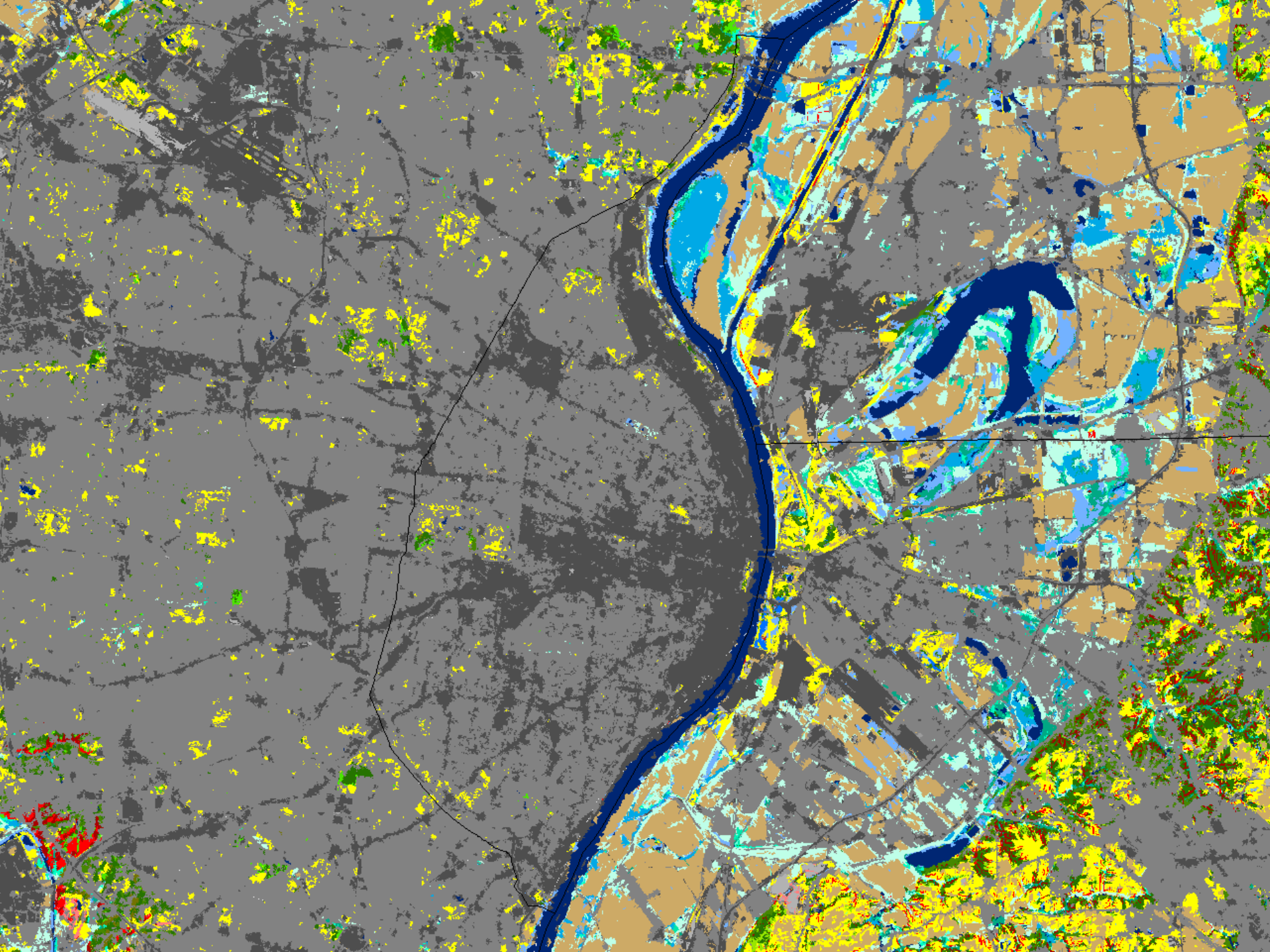
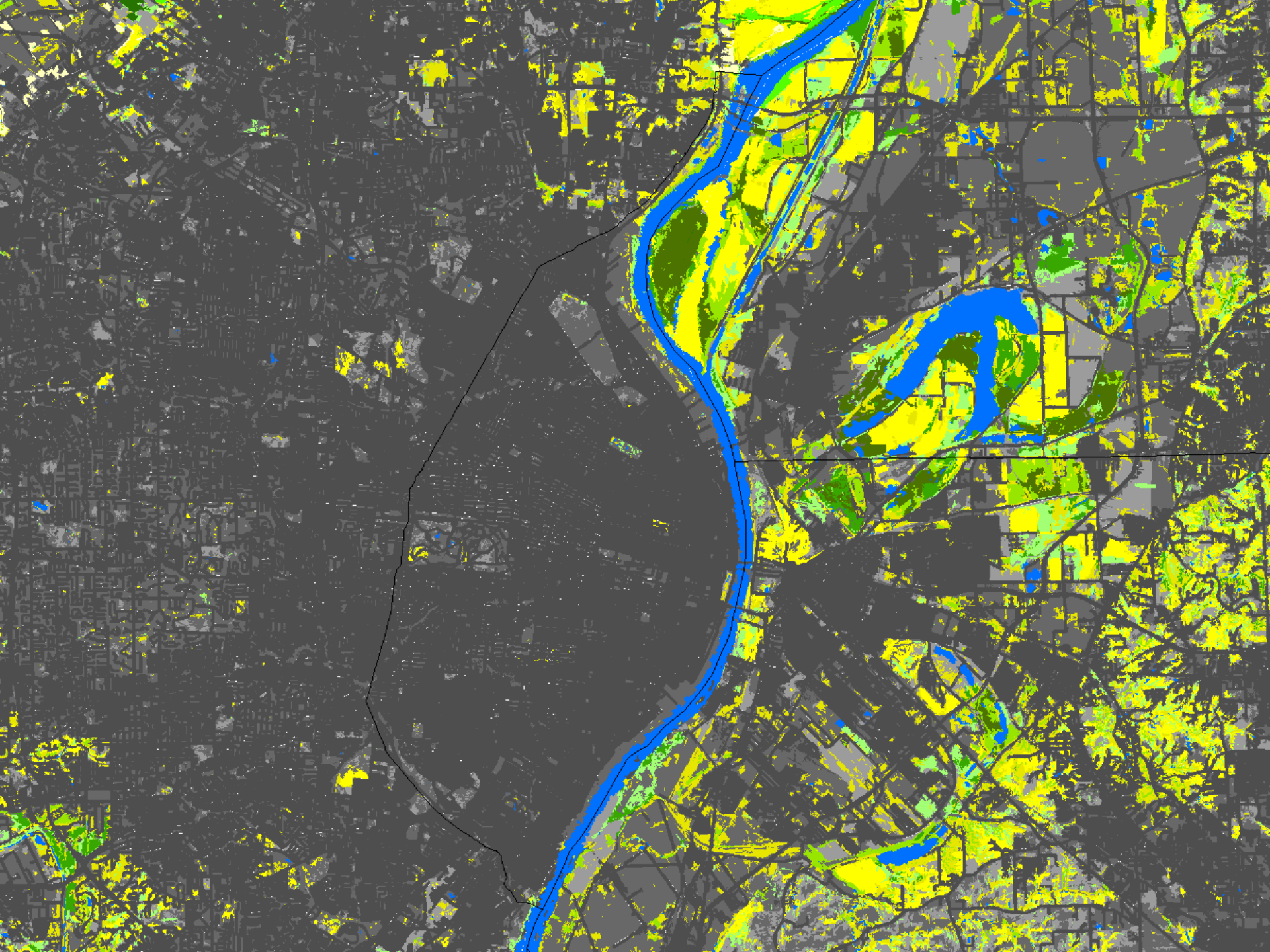
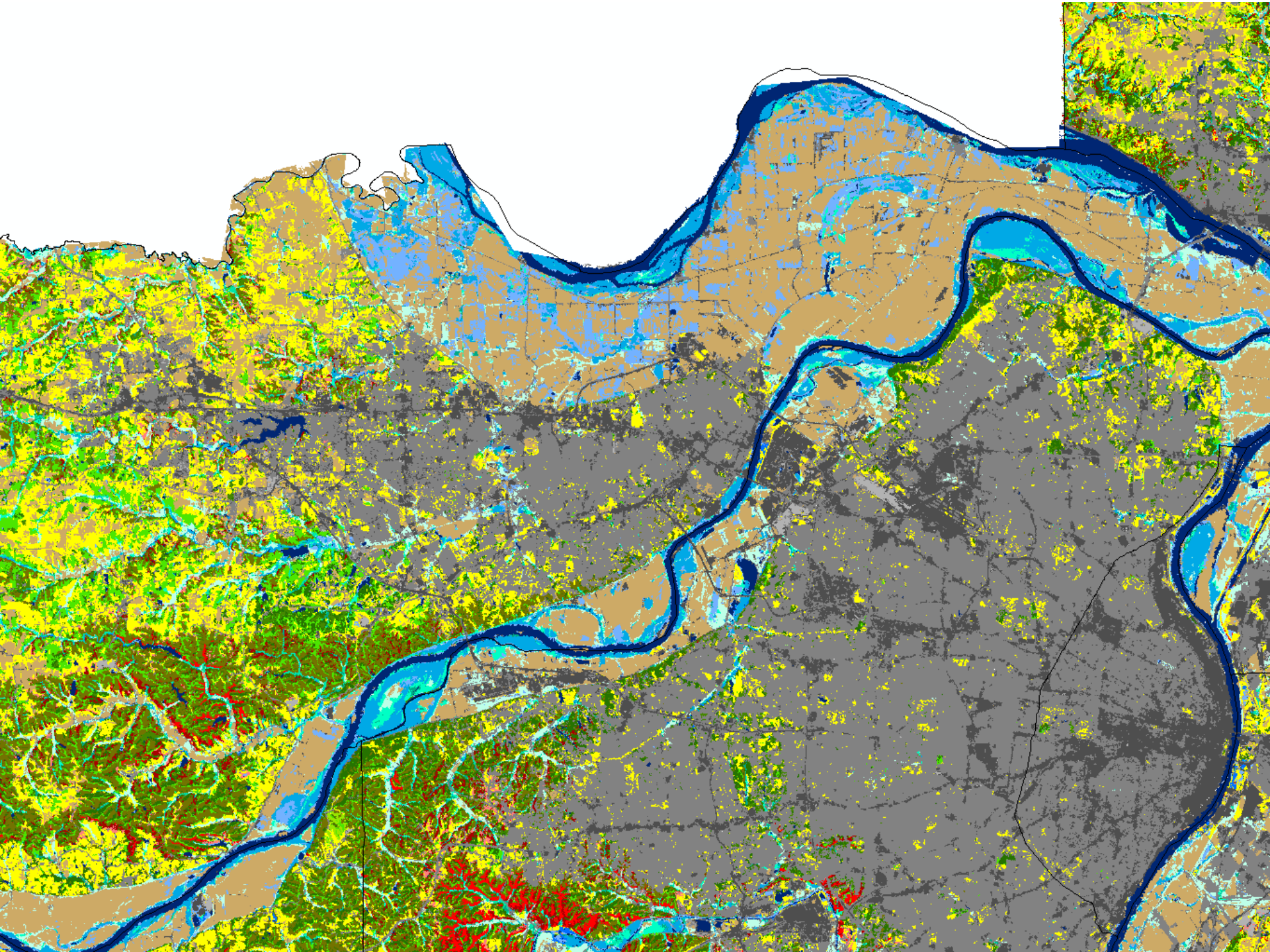
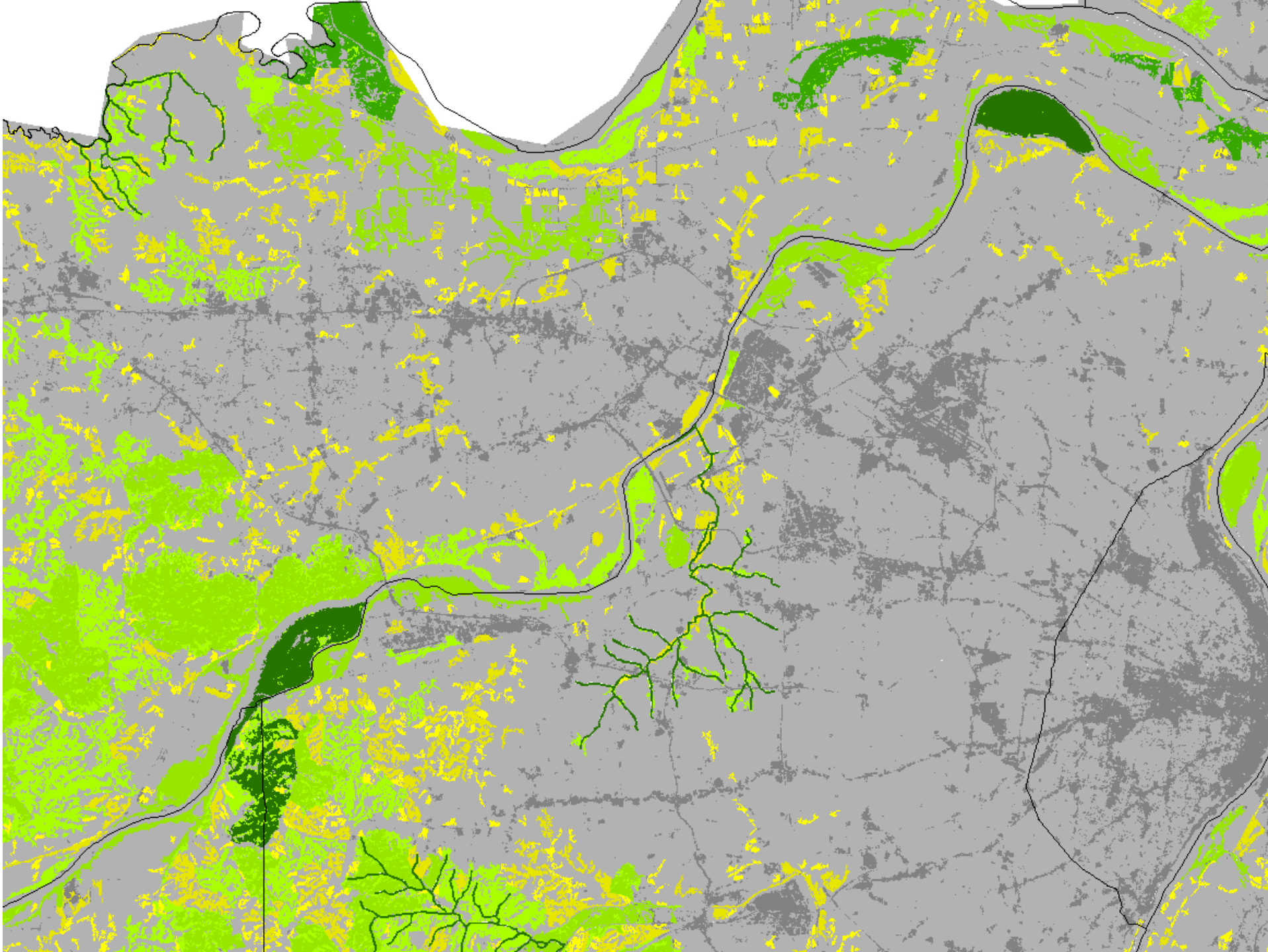
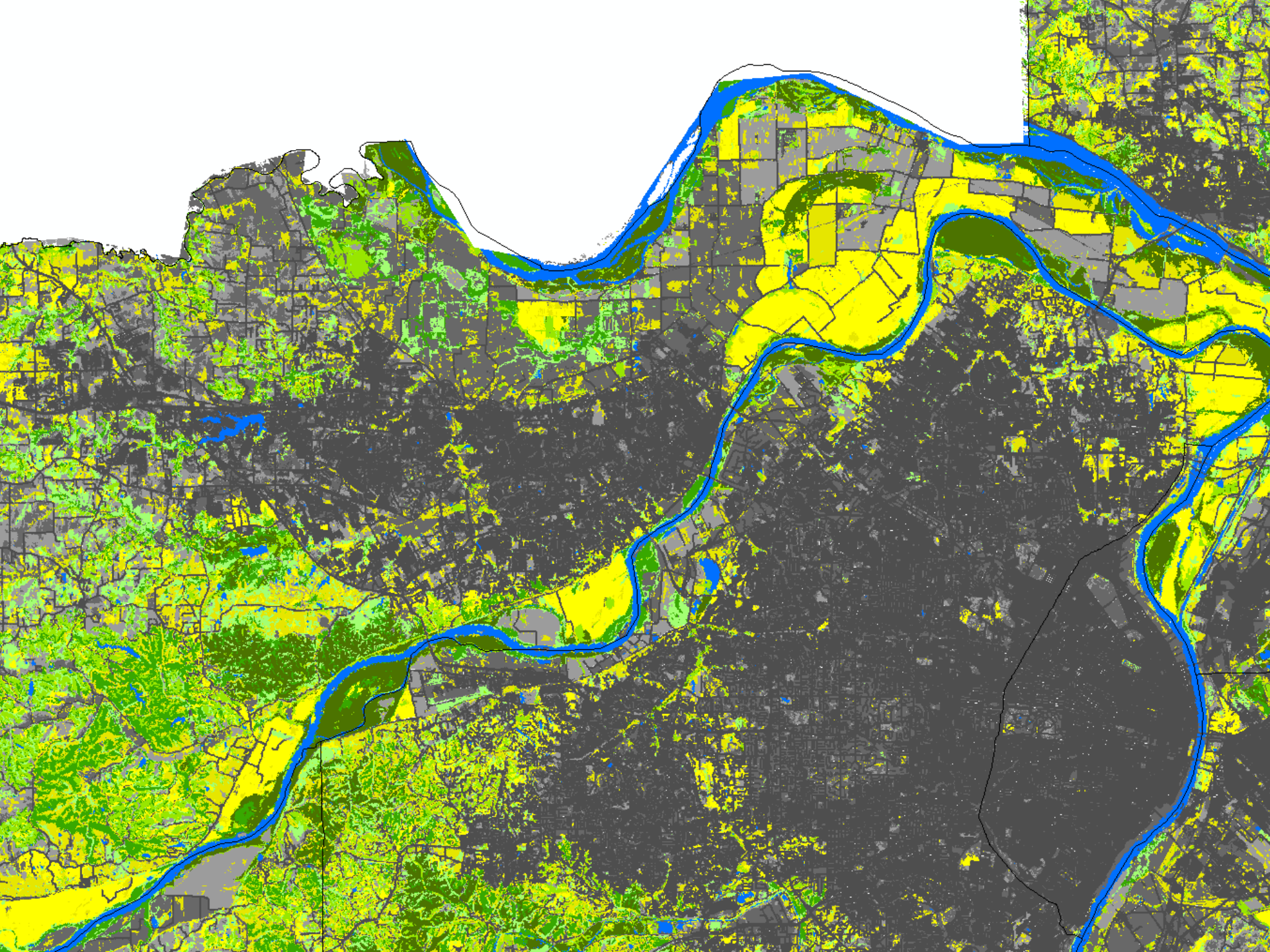
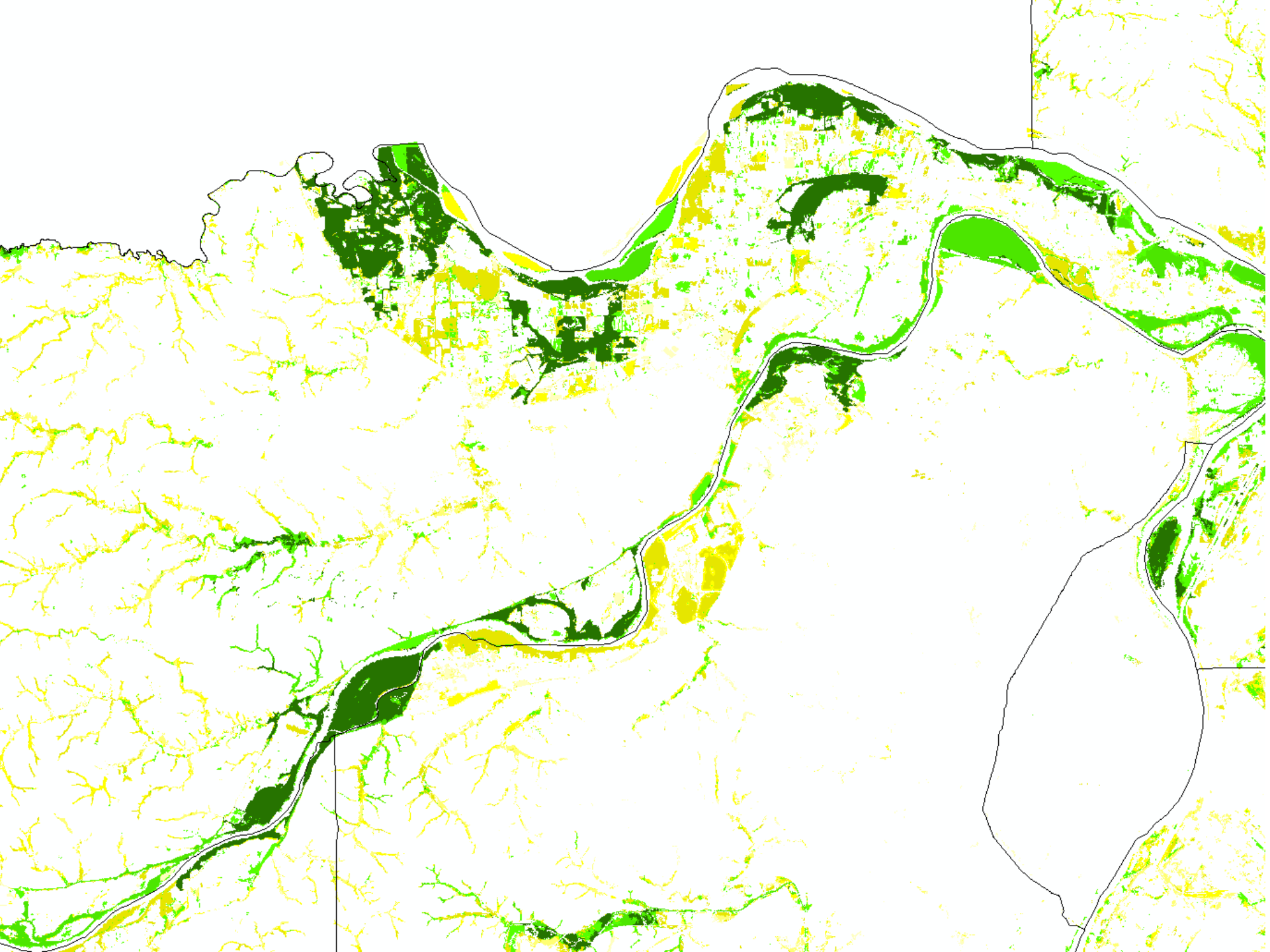
Project- level Ecological Significance



Project- level Ecological Significance





Nothing in life is so exhilarating as to be shot at without result.
– Winston Churchill

diamondd@missouri.edu