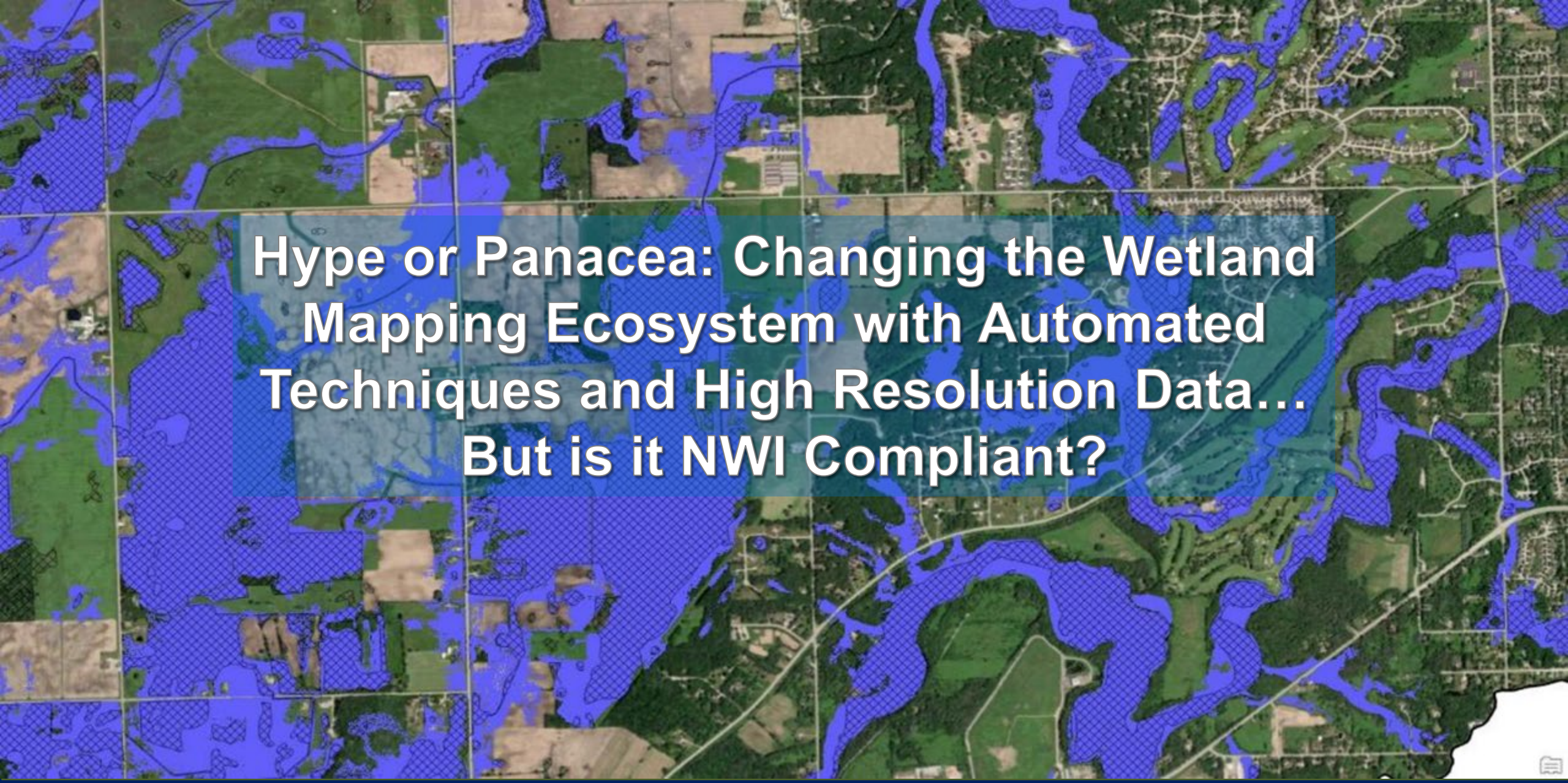
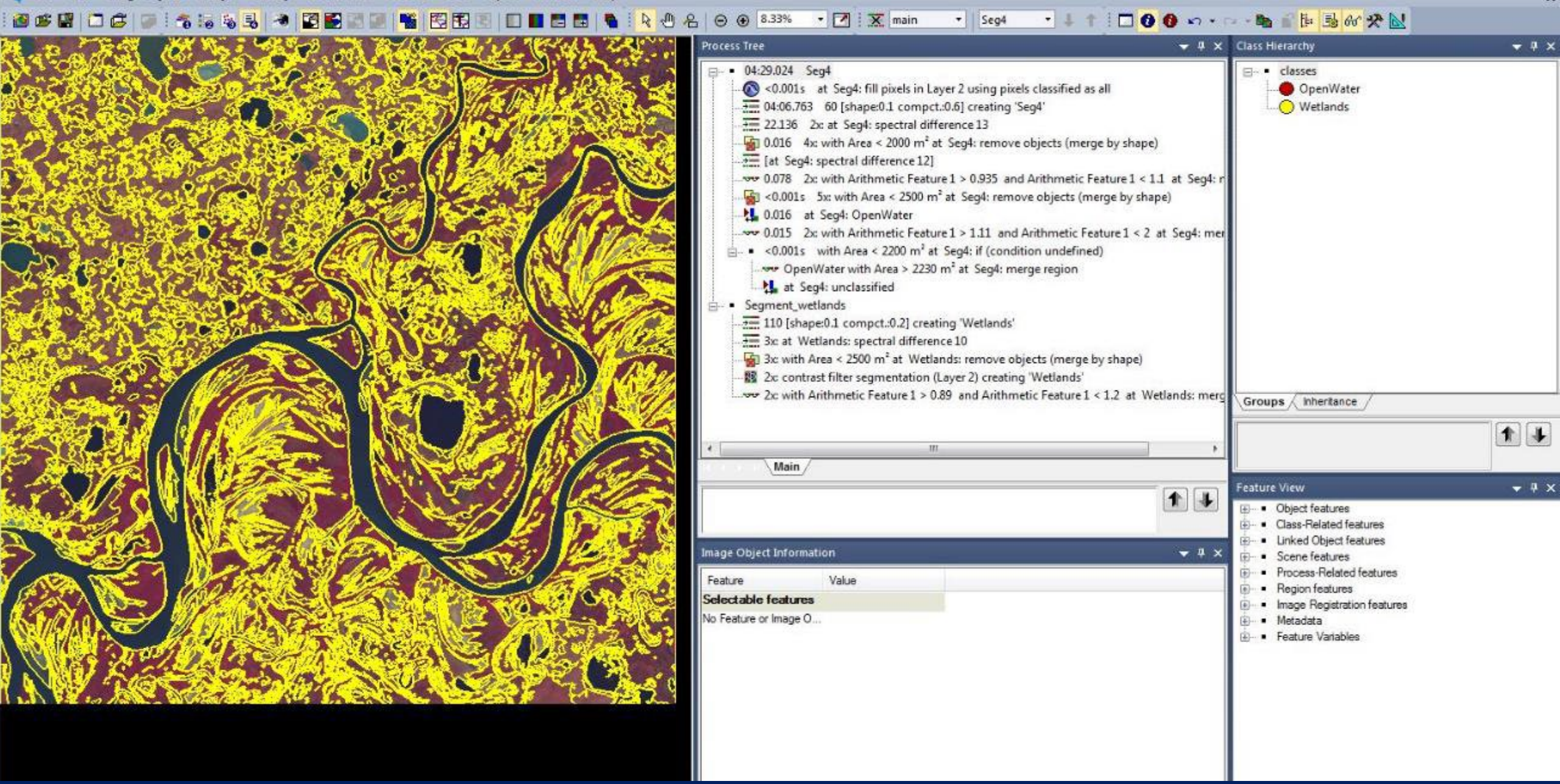


Hype or Panacea: Changing the Wetland Mapping Ecosystem with Automated Techniques and High Resolution Data… But is it NWI Compliant?

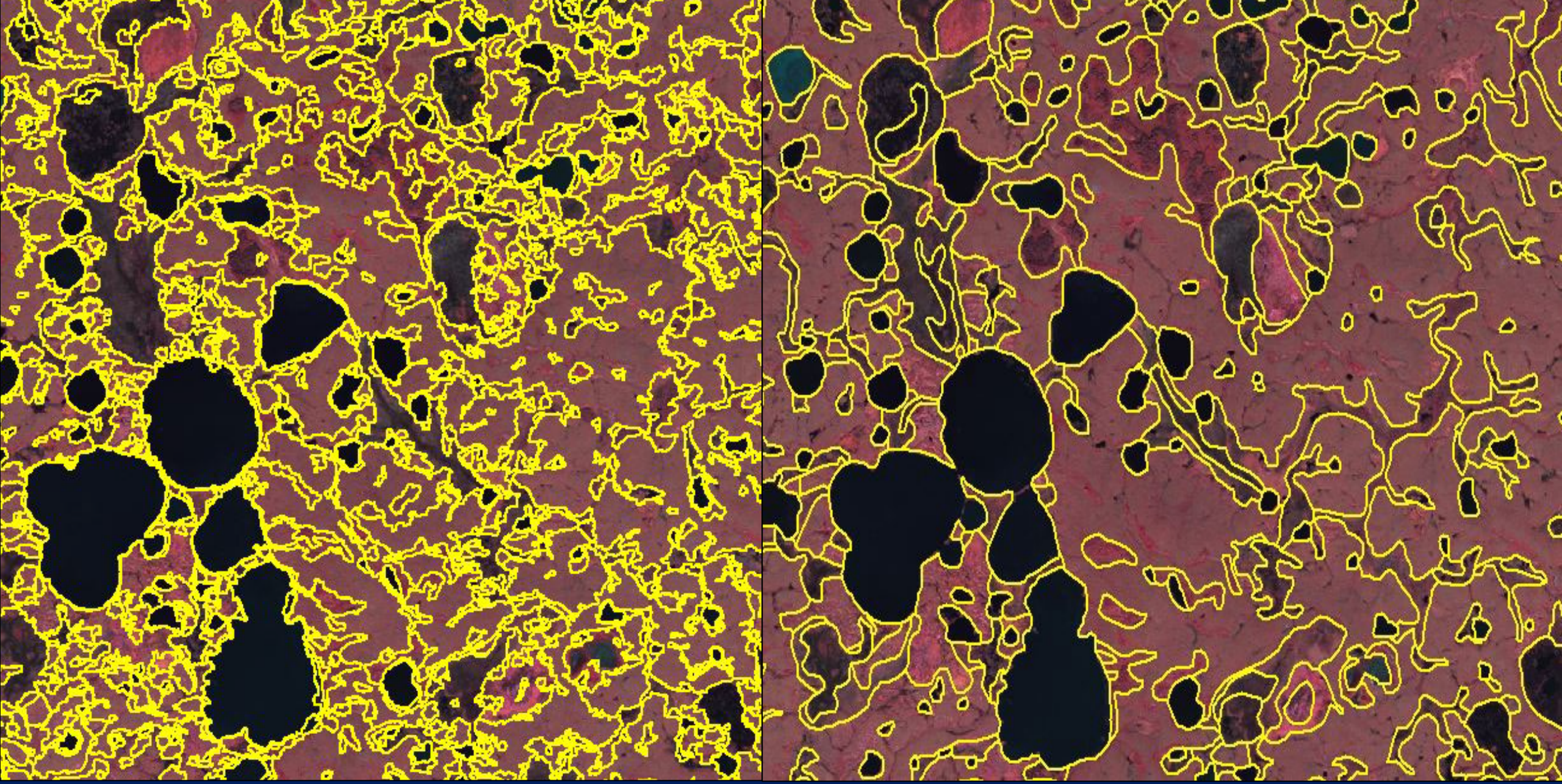
Saint Mary's University
GEOSPATIAL SERVICES

Wetland Mapping Consortium
National Association of Wetland Managers
April 09, 2026



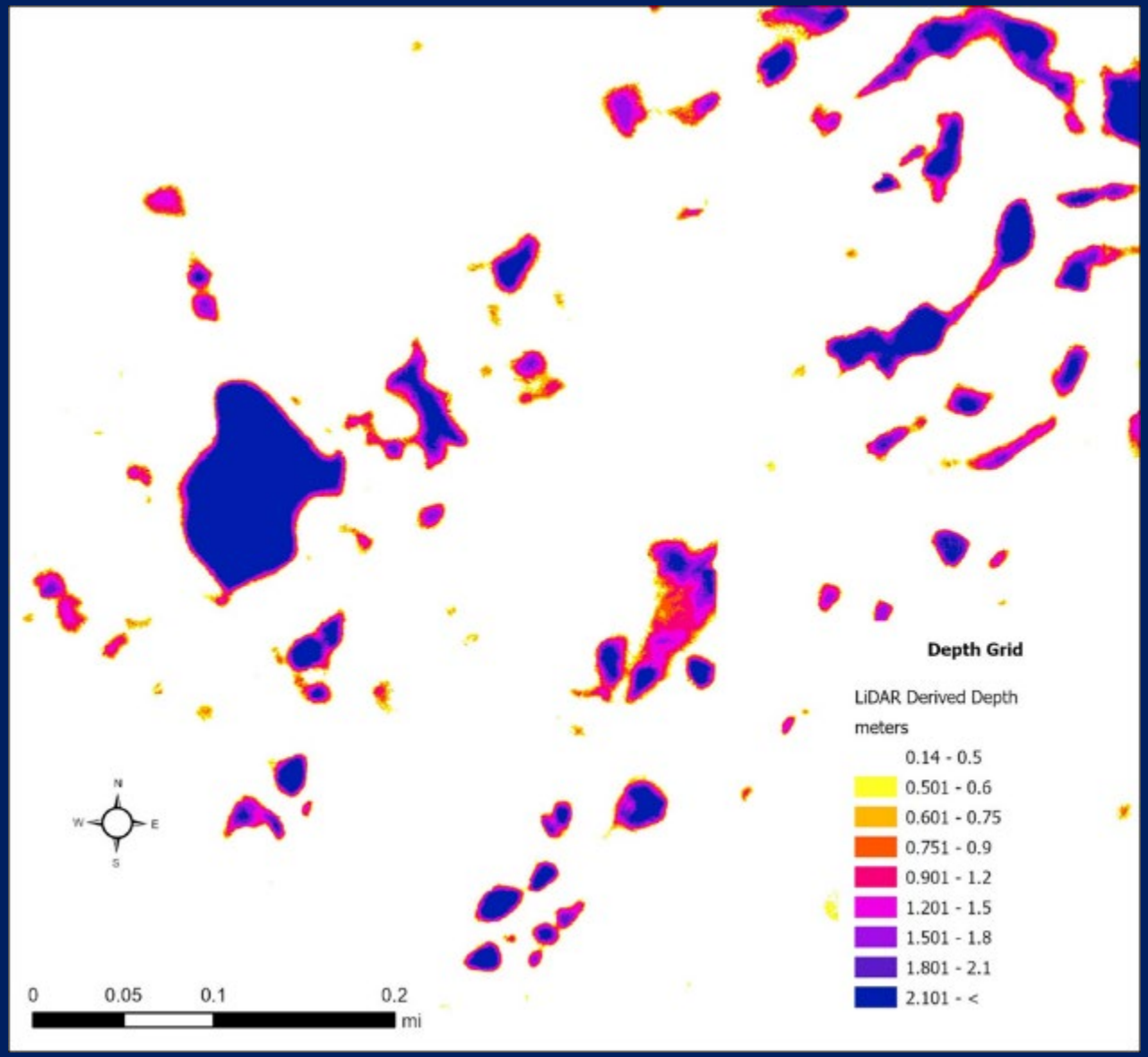
Saint Mary's University
GEOSPATIAL SERVICES

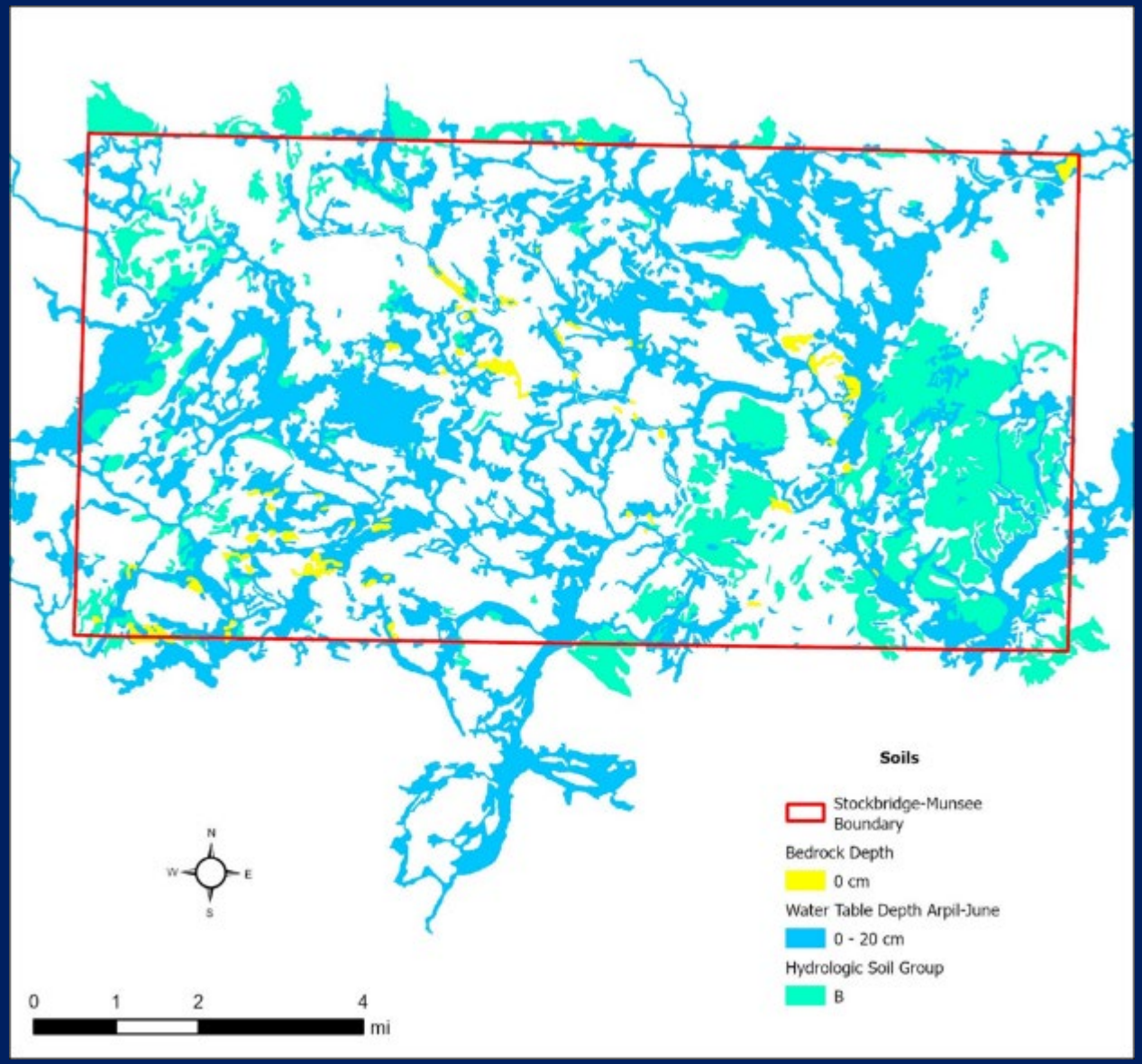
Object Segmentation and Classification



Saint Mary's University
GEOSPATIAL SERVICES

Object Segmentation and Classification





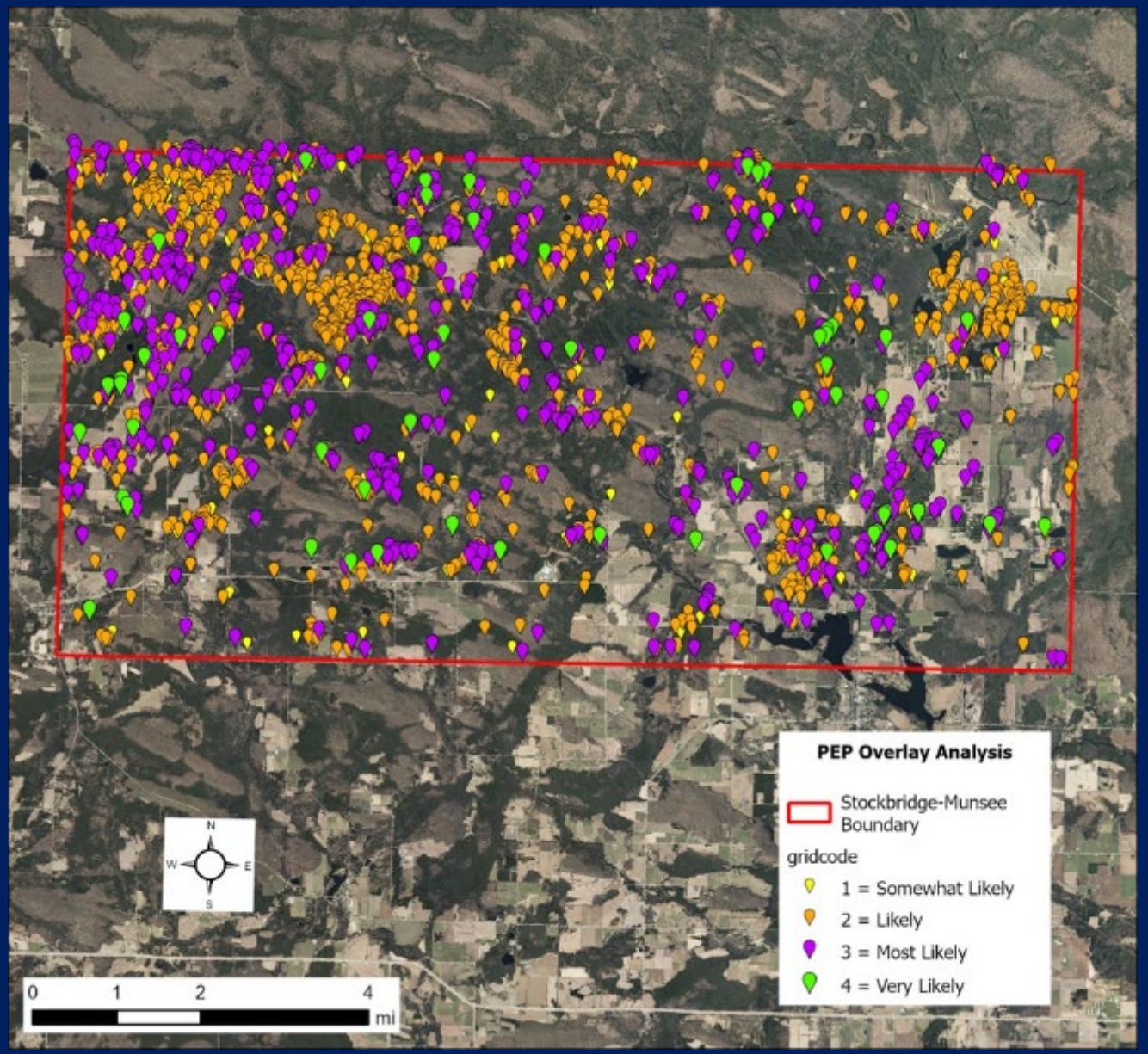
Saint Mary's University
GEOSPATIAL SERVICES

Potential Ephemeral Pond Identification

Saint Mary's University of Minnesota
GeoSpatial Services

Saint Mary's University

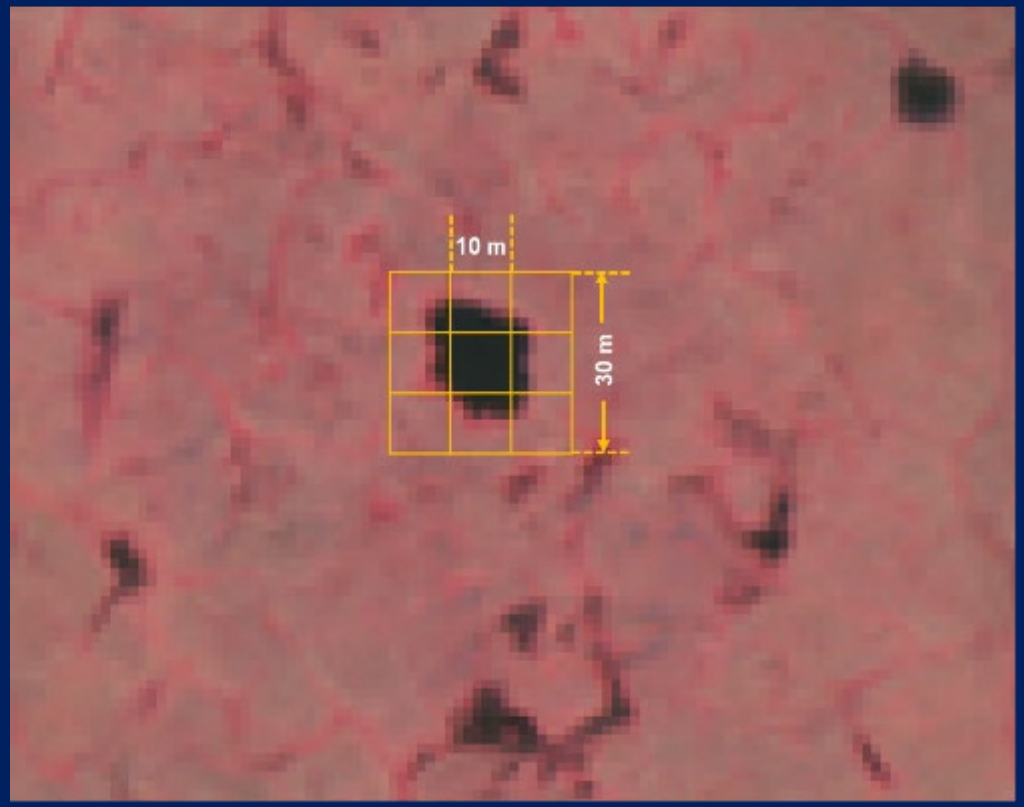
A Wetland Mapping Update and Identification of Potential Ephemeral Ponds for the Stockbridge-Munsee Community



Saint Mary's University
GEOSPATIAL SERVICES

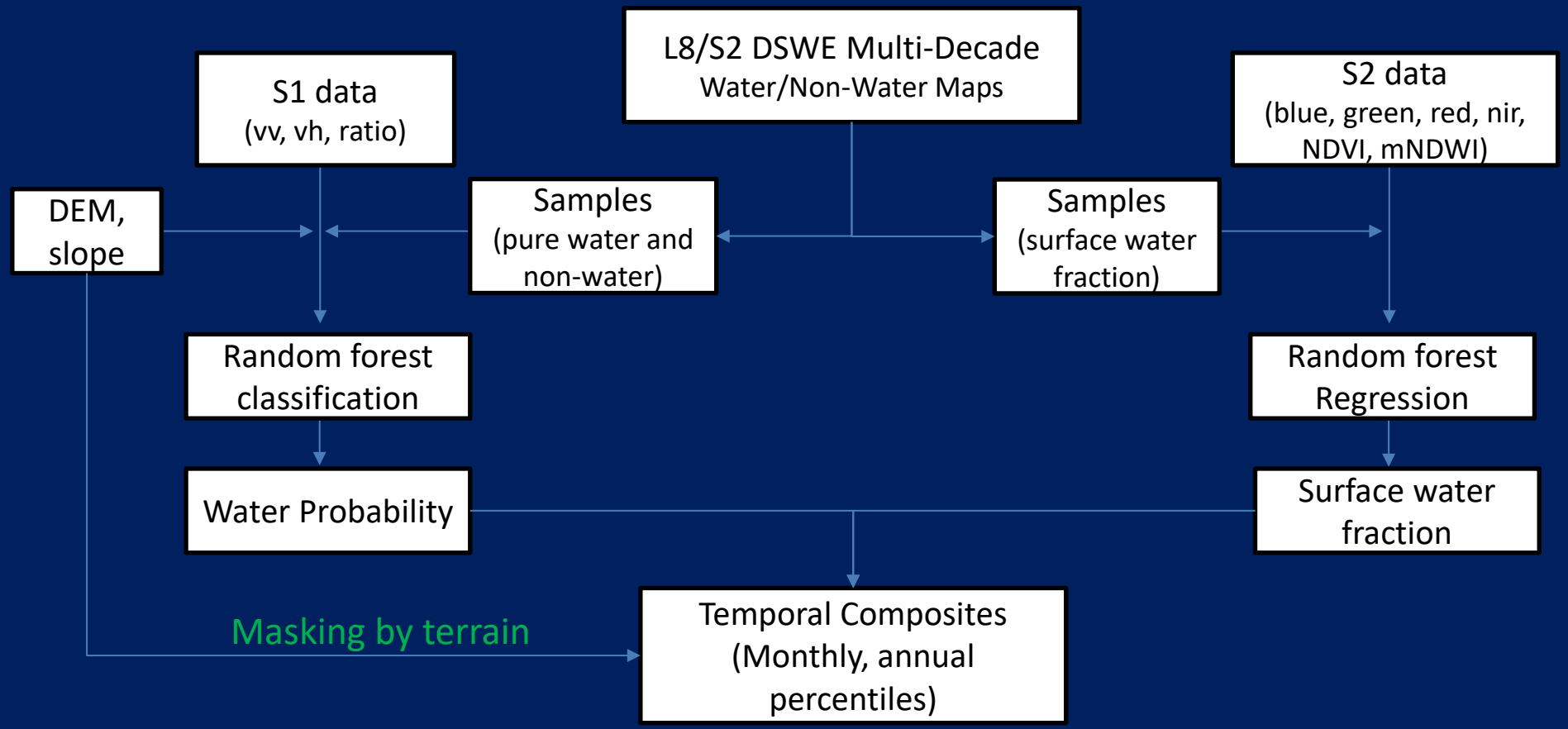
Potential Ephemeral Pond Identification

Mapping Algorithms Designed to Capture Small Features using Surface Water Fraction (SWF)



SWF is not indicative of saturation, which needs to be modeled separately

Processing Flow

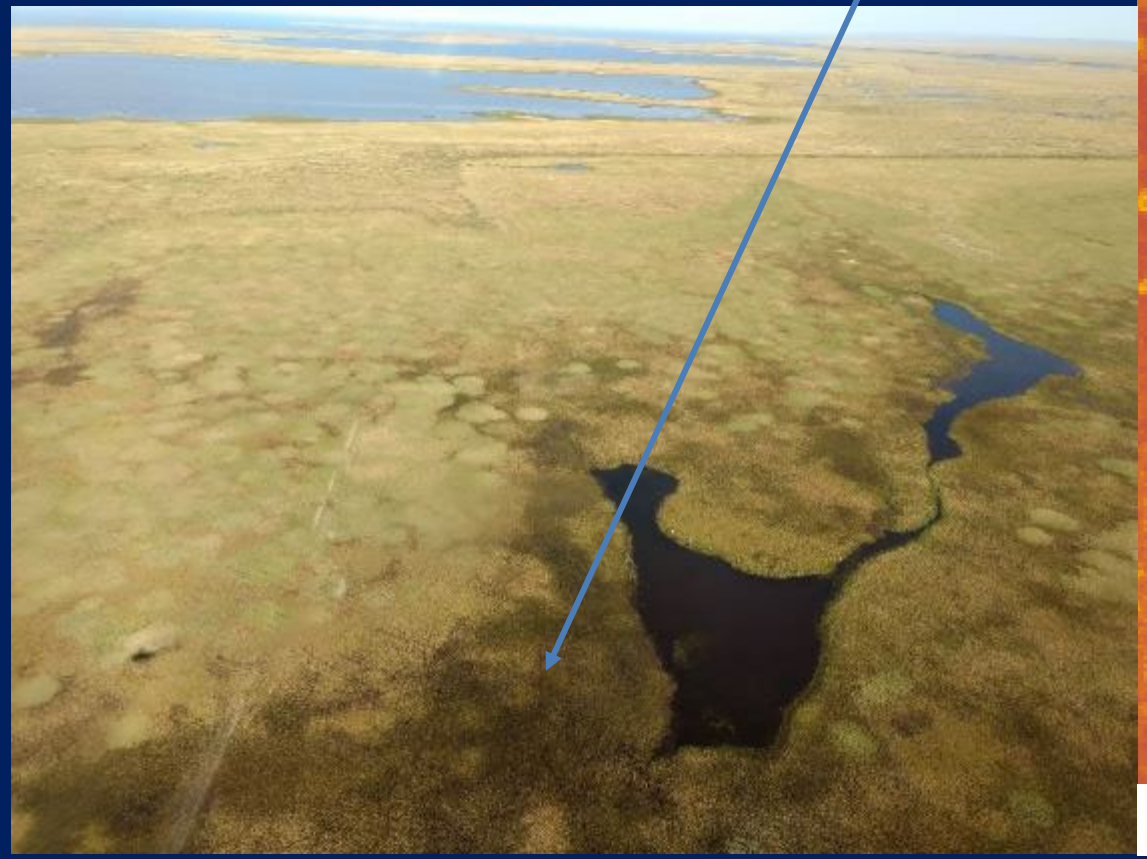


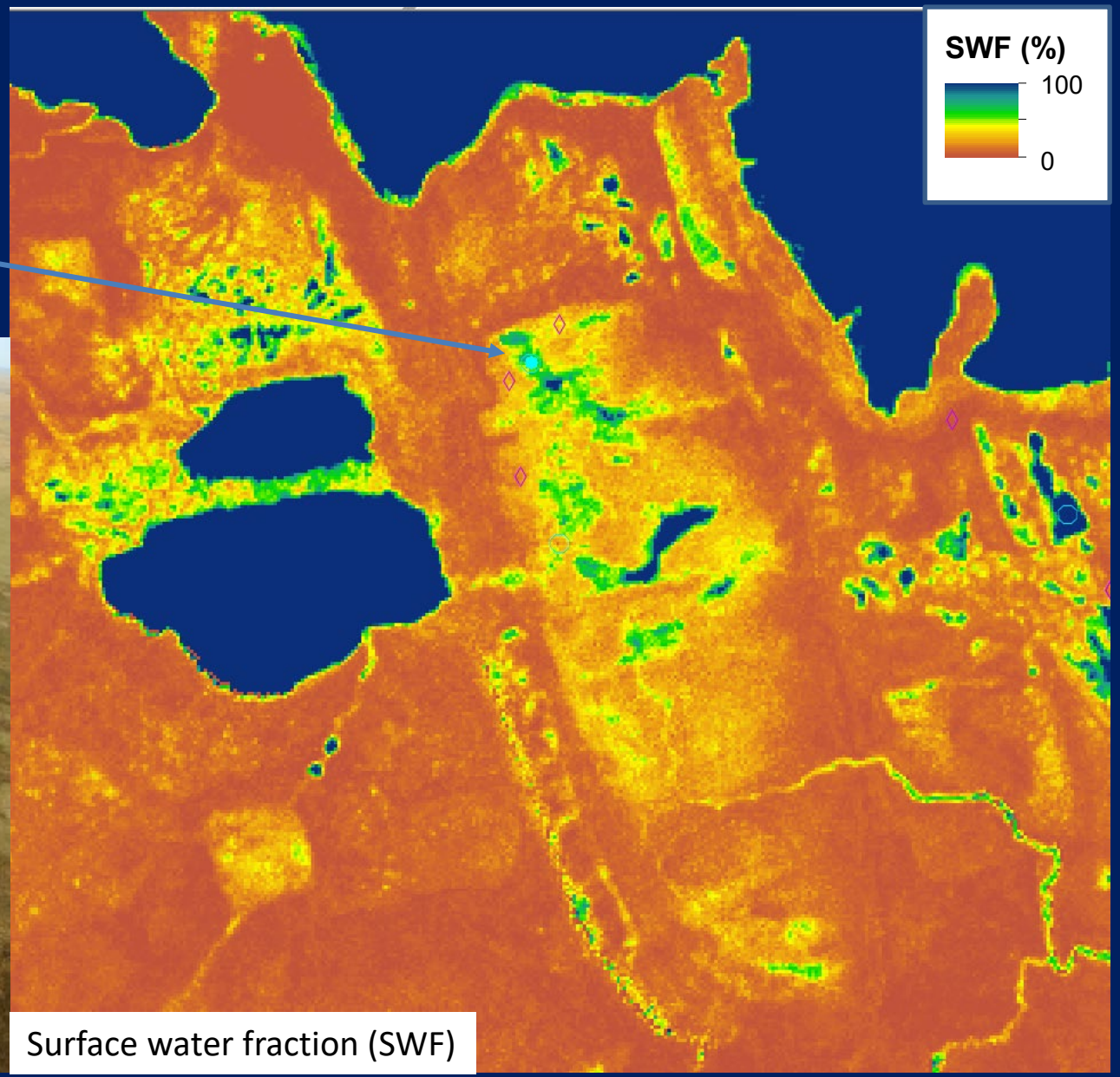
Saint Mary's University GEOSPATIAL SERVICES

Alaska – Derived Surface Water Mapping

Water Regime Gradients Well Captured

Semi-permanently flooded area



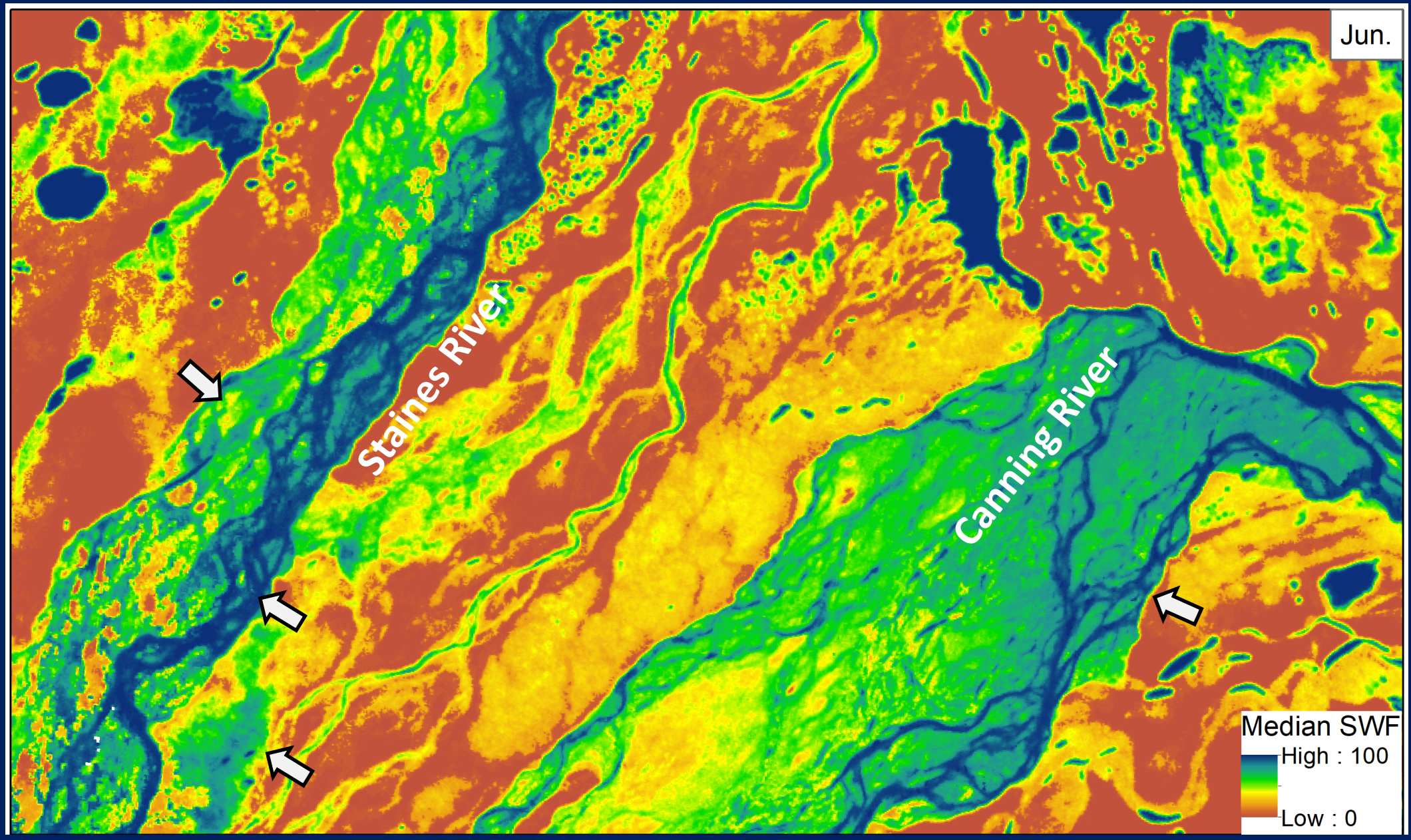


Surface water fraction (SWF)

Saint Mary's University
GEOSPATIAL SERVICES

Alaska – Derived Surface Water Mapping

Monthly SWF Composites



Saint Mary's University
GEOSPATIAL SERVICES

Alaska – Derived Surface Water Mapping

Simplified PW GIS Model

$$PW = (A + B) - (W + U)$$

A = CTI values > 9.5* (*raster cells*)

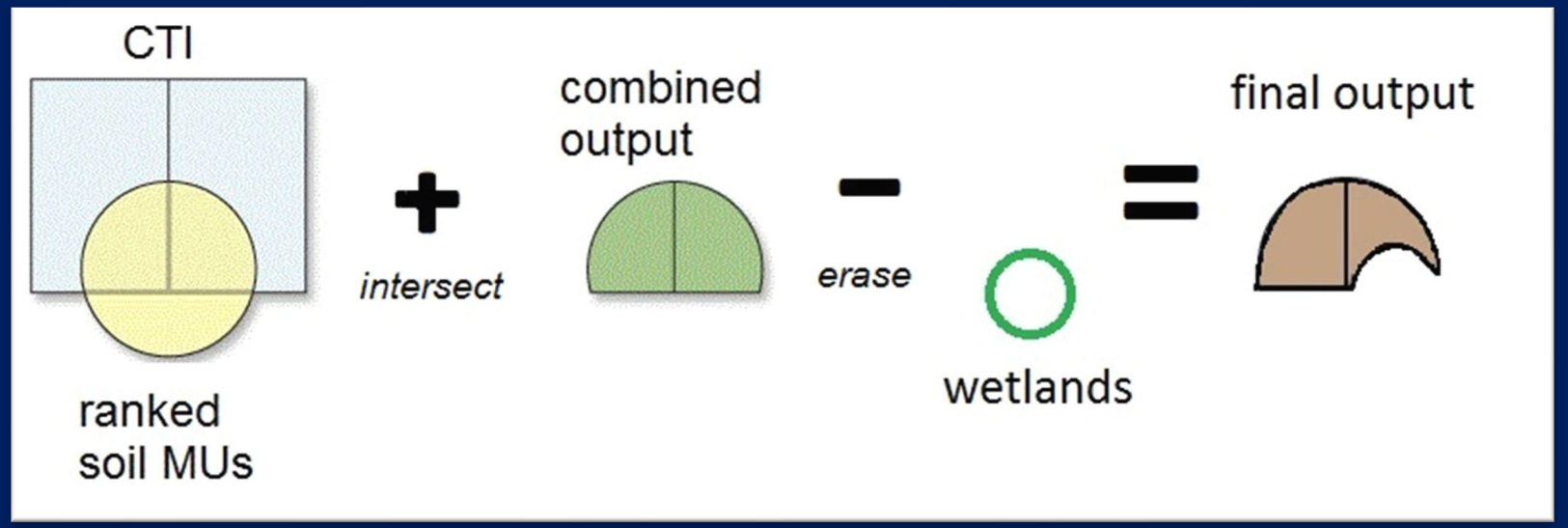
B = hydric soils (*polygons*)

W = current wetland boundaries (*polygons*)

U = incompatible land uses (e.g., urban)

+ = Intersect ArcGIS tool

- = Erase ArcGIS tool



Saint Mary's University GEOSPATIAL SERVICES

Prairie Pothole Automated Wetlands

Developing a Machine Learning Approach

LiDAR Data Derivatives	Soil Data Derivatives	Vegetation/Land Cover
✓ Contour Topographic Index	✓ Hydric Soils	CropLand
Slope	Drainage Condition	Historic Vegetation
Aspect	Flooding Frequency	Land Cover/Land Use
Curvature	Soil Texture	Pre-settlement Vegetation
Drainage Ditches	Soil Porosity	✓ NWI
Flow Direction	Saturation	Local Wetland Inventory
Flow Accumulation		
Height Above Nearest Drainage		

Optimized Random Forest

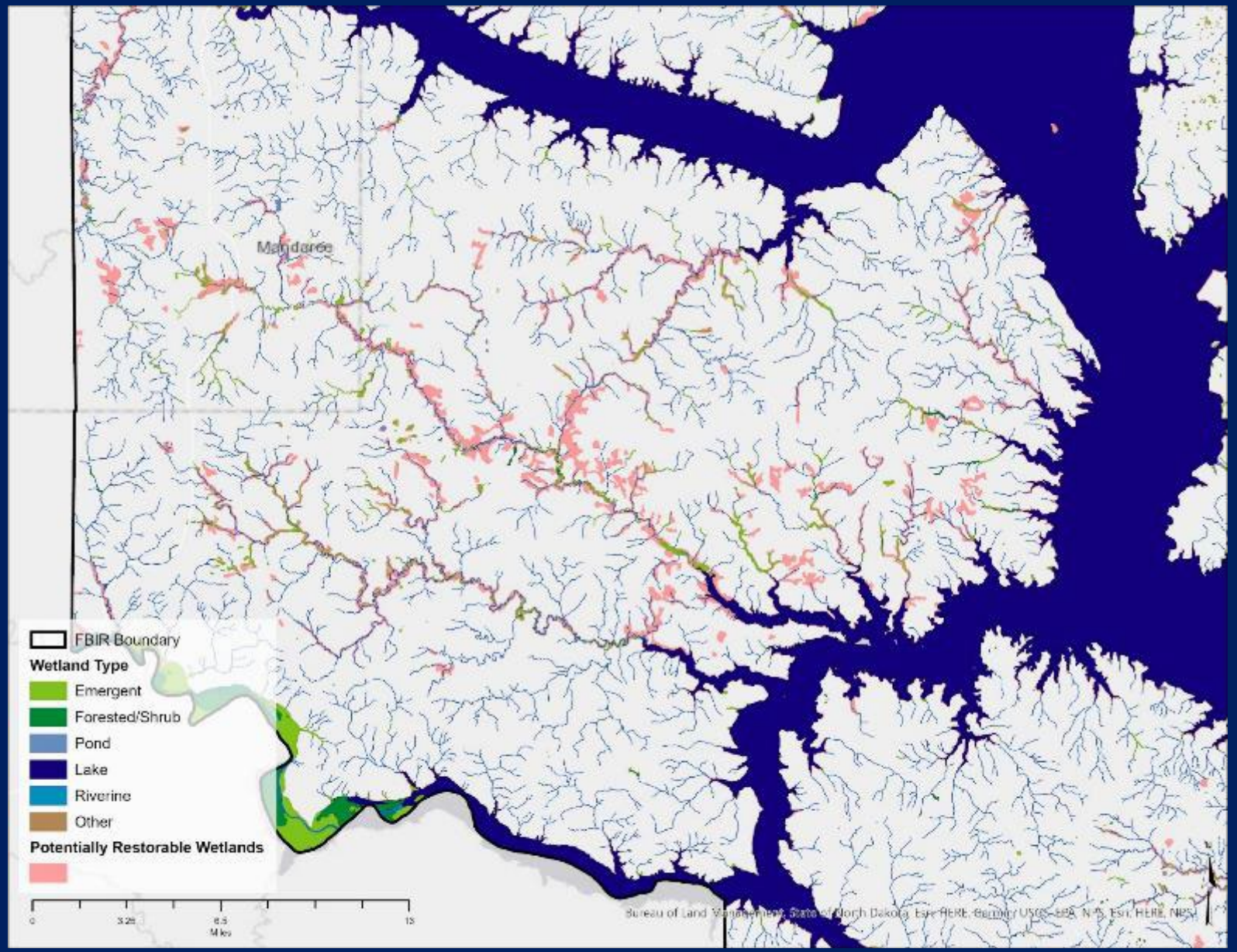
- **Variables**
- CTI
- Surface Curvature
- Hydric Soils
- Slope
- Soil Wetness
- Potential Wetland Landscape
- Water Regime

- **Confusion Matrix**

Accuracy	0.8240
Sensitivity	0.7046
Specificity	0.8849
Precision	0.7574
Recall	0.7046
F1 Score	0.7300

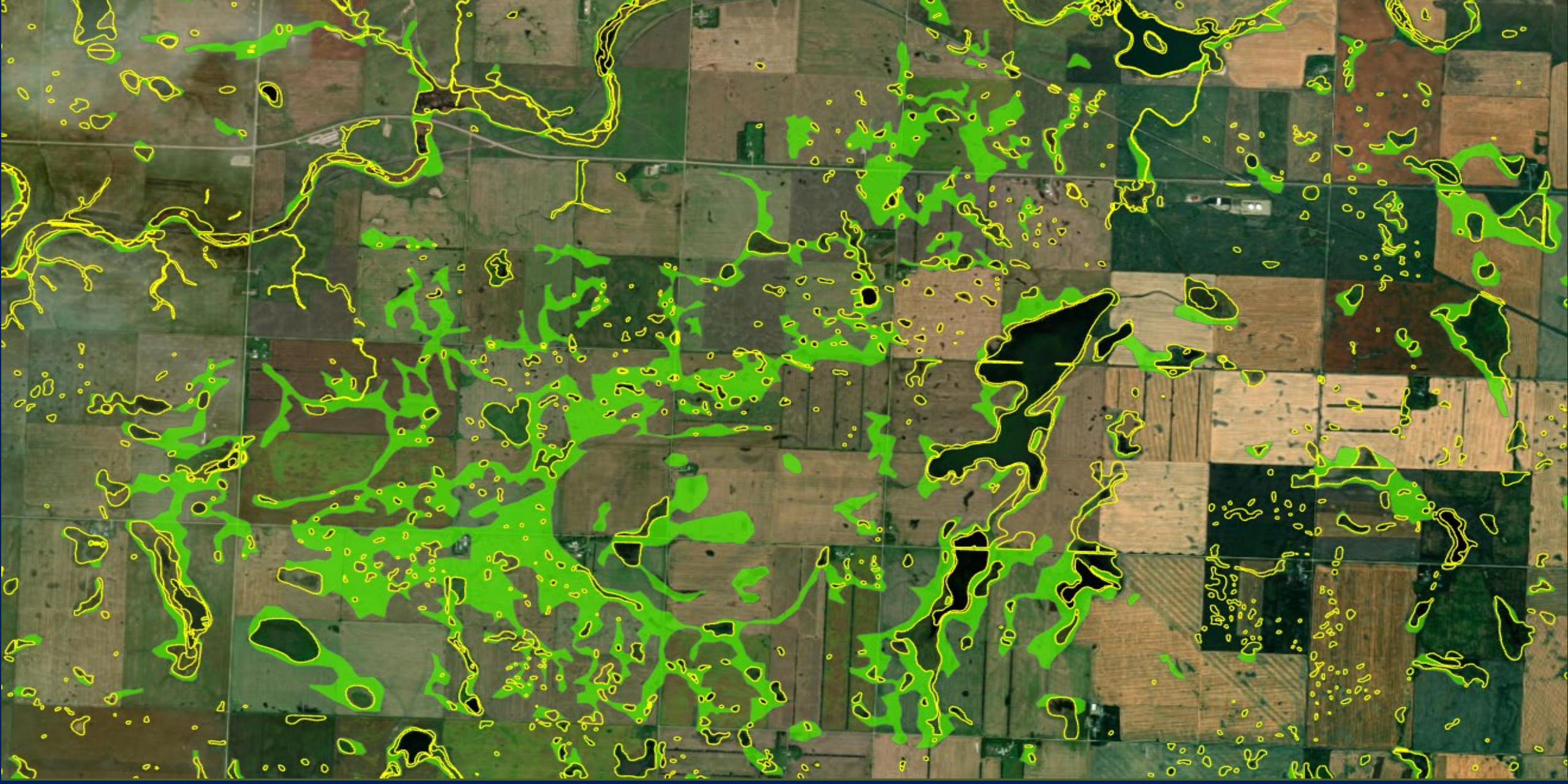
Saint Mary's University
GEOSPATIAL SERVICES

Prairie Pothole Automated Wetlands



Saint Mary's University
GEOSPATIAL SERVICES

Prairie Pothole Automated Wetlands



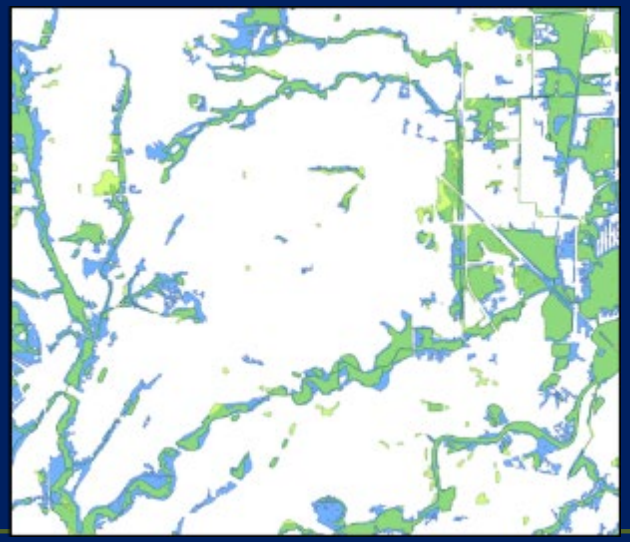
Saint Mary's University
GEOSPATIAL SERVICES

Prairie Pothole Automated Wetlands

Optimized Random Forest Model

LiDAR DEM Derivatives	Hydric Soils	Reflectance (NAIP)	Hydrologic
Curvature *	SSURGO percent hydric *	NDVI *	NHD waterbodies and streams
Topographic Wetness Index* (TWI)	SSURGO water regime*	6 class landcover*	HUC 12 watershed boundaries
Depth to Water Index (DTW)*			Wetland training polygons

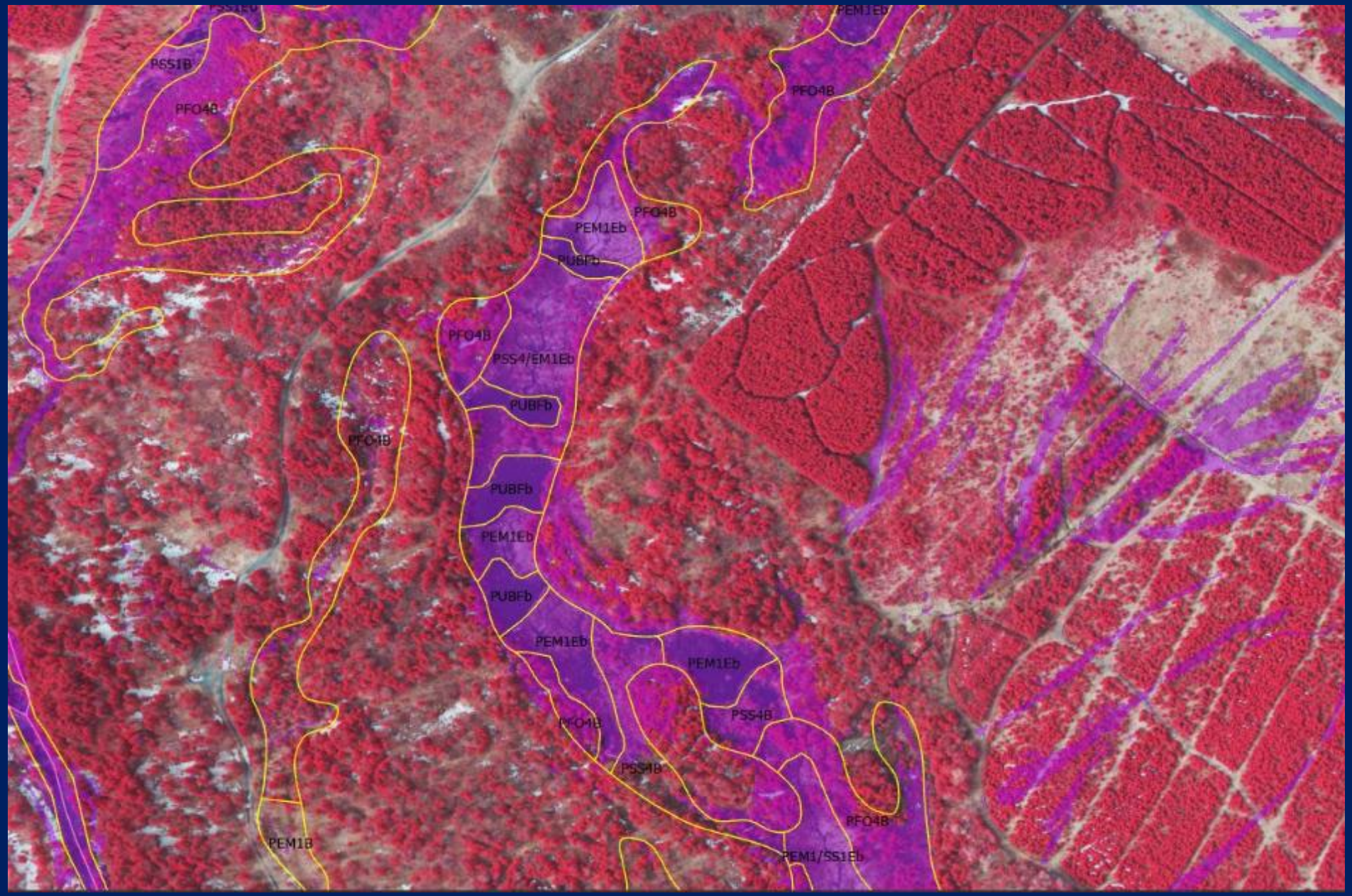
* Predictor variables used in RF classification



Saint Mary's University
GEOSPATIAL SERVICES

Vermont Automated Wetlands

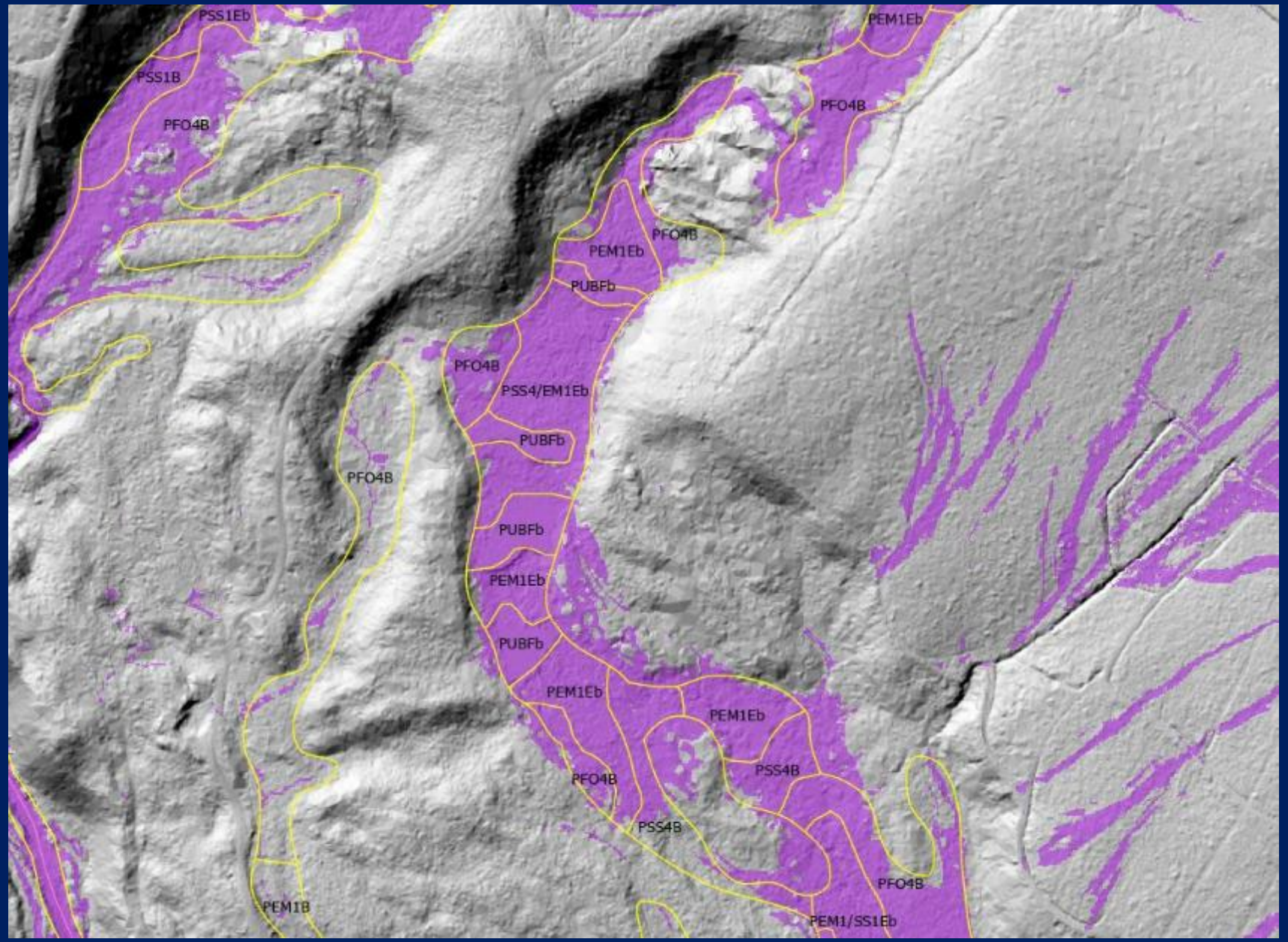
Beaver Created Wetlands



Saint Mary's University
GEOSPATIAL SERVICES

Vermont Automated Wetlands

Beaver Created Wetlands



Saint Mary's University
GEOSPATIAL SERVICES

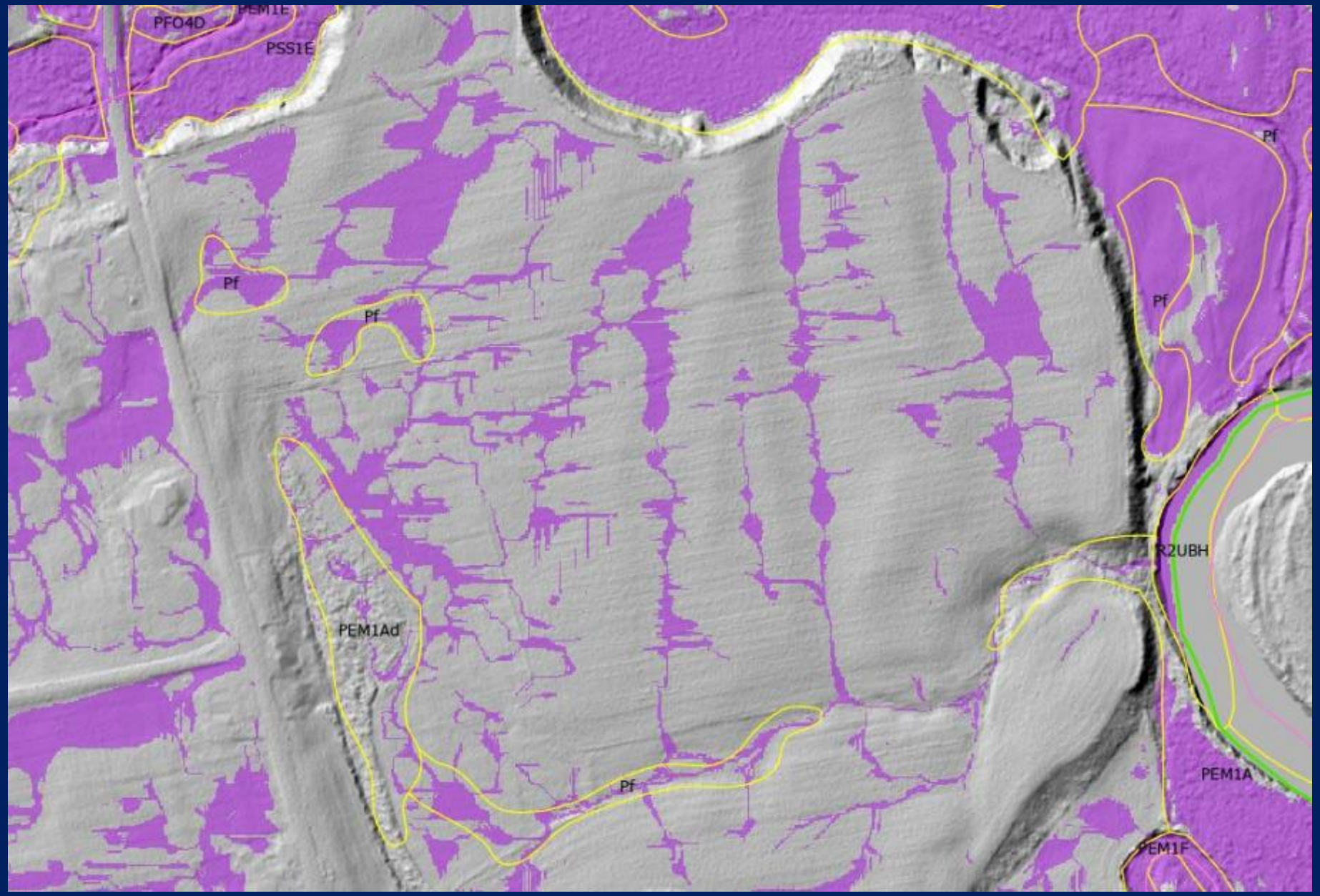
Vermont Automated Wetlands

Beaver Created Wetlands

Saint Mary's University
GEOSPATIAL SERVICES

Vermont Automated Wetlands

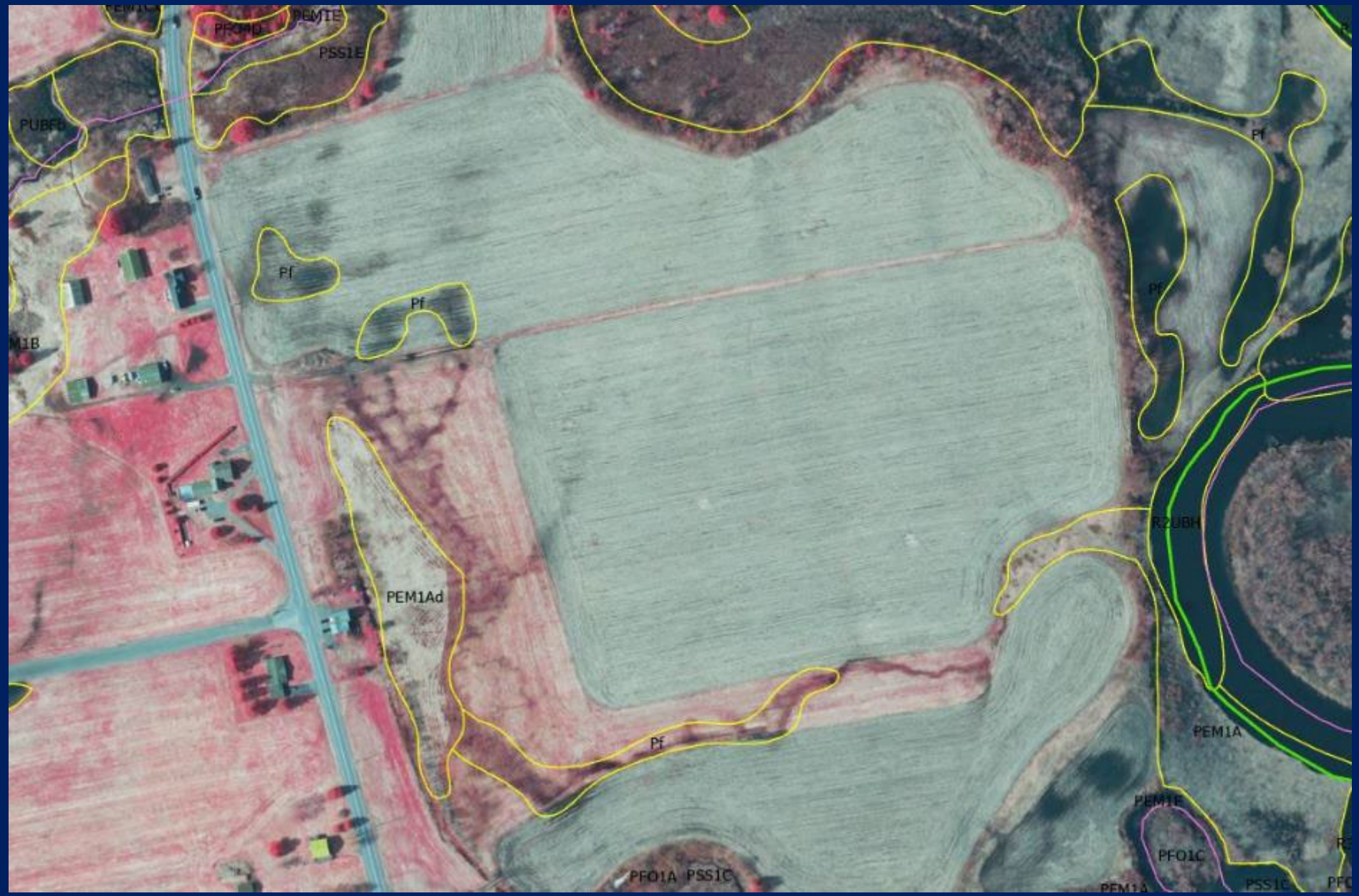
Farmed Wetlands



Saint Mary's University
GEOSPATIAL SERVICES

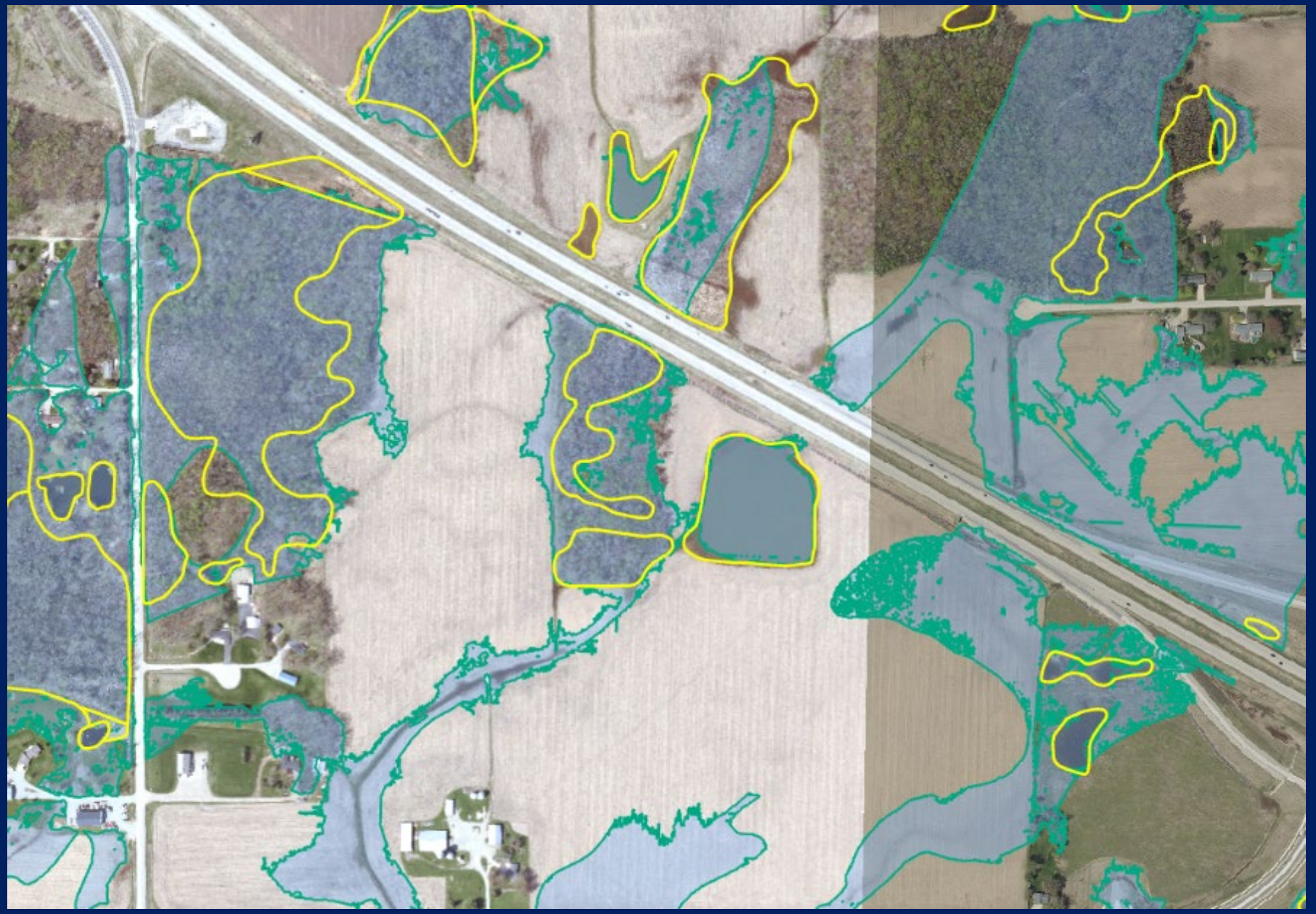
Vermont Automated Wetlands

Farmed Wetlands



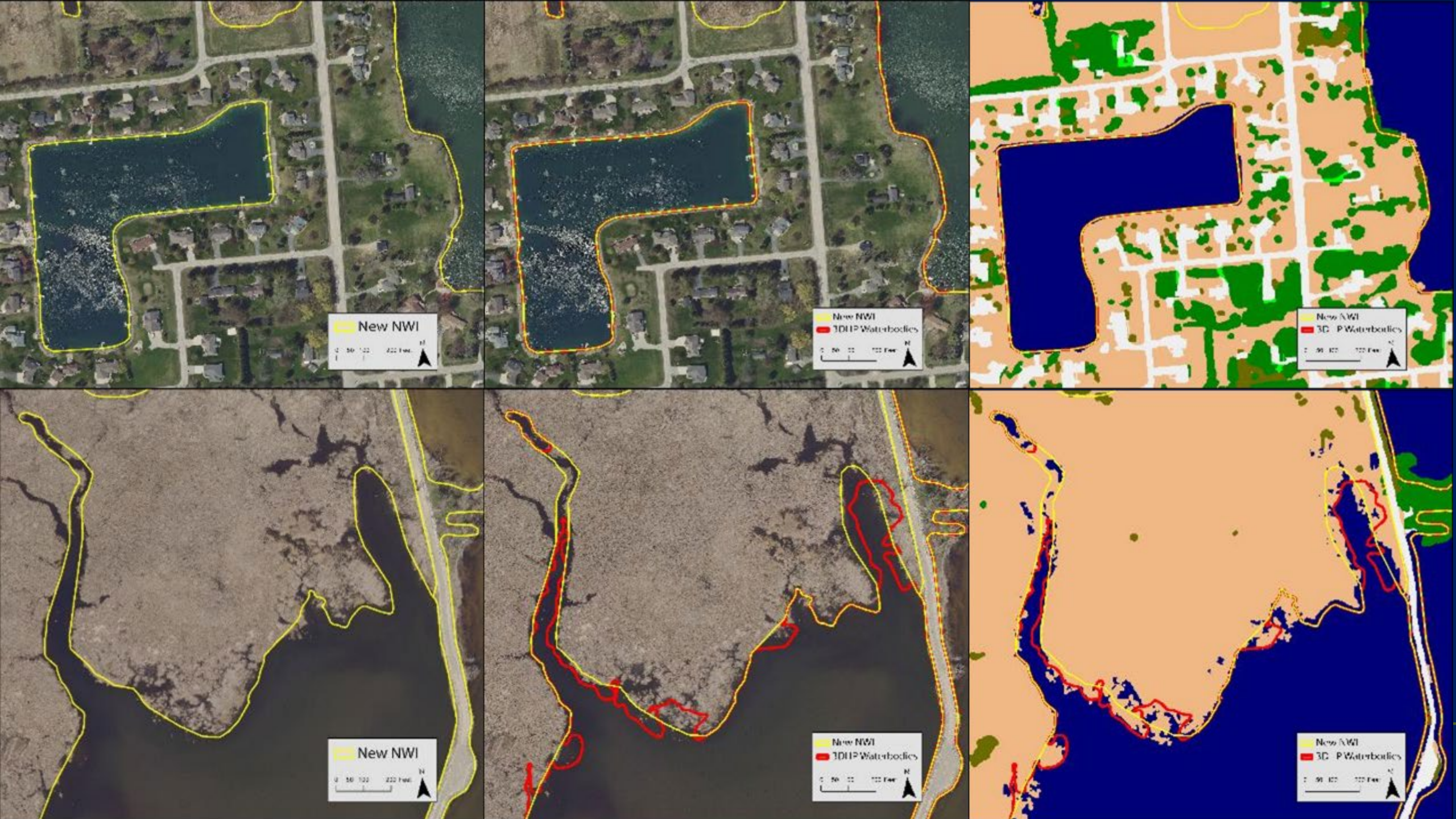
Saint Mary's University
GEOSPATIAL SERVICES

Vermont Automated Wetlands



Saint Mary's University
GEOSPATIAL SERVICES

Wisconsin Automated Wetlands


New NWI
New NWI
3DHP Waterbodies
New NWI
3DHP Waterbodies
New NWI
New NWI
3DHP Waterbodies
New NWI
3DHP Waterbodies

Lessons Learned

Three elements we know conflict are source data, vintage, and feature representation

- Source data
  - 3DHP: Lidar: 3DEP Vintage 2015, 2018, 2020
  - NWI: Imagery: Latest Vintage 2023
  - CCAP: Imagery: NAIP Vintage 20/21
- Water bodies
  - 3DHP: MMU 0.25 acres (vector – semi-automated)
  - NWI: MMU 0.25 acres – vegetated;
    0.1 acres – water (vector – manual)
  - CCAP: MMU 0.25 acres (1 m pixels – semi-automated)
- Rivers
  - 3DHP: Min width (15 m)
  - NWI: Min width (15 ft)
  - CCAP: (3 pixels of open water 3 m, not a rule)

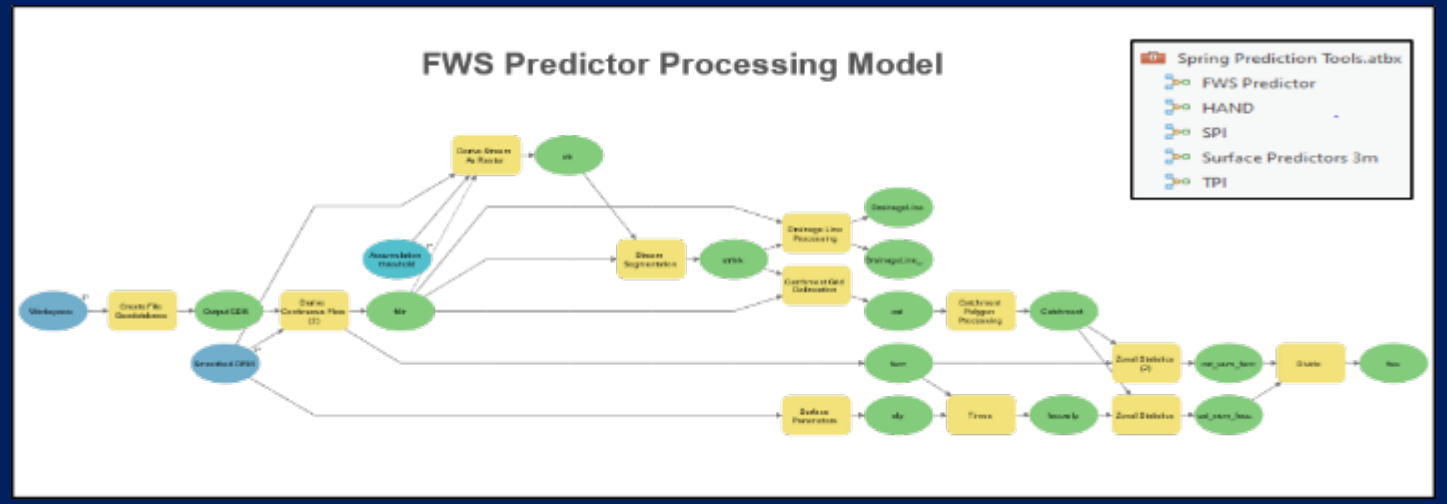
Lessons Learned

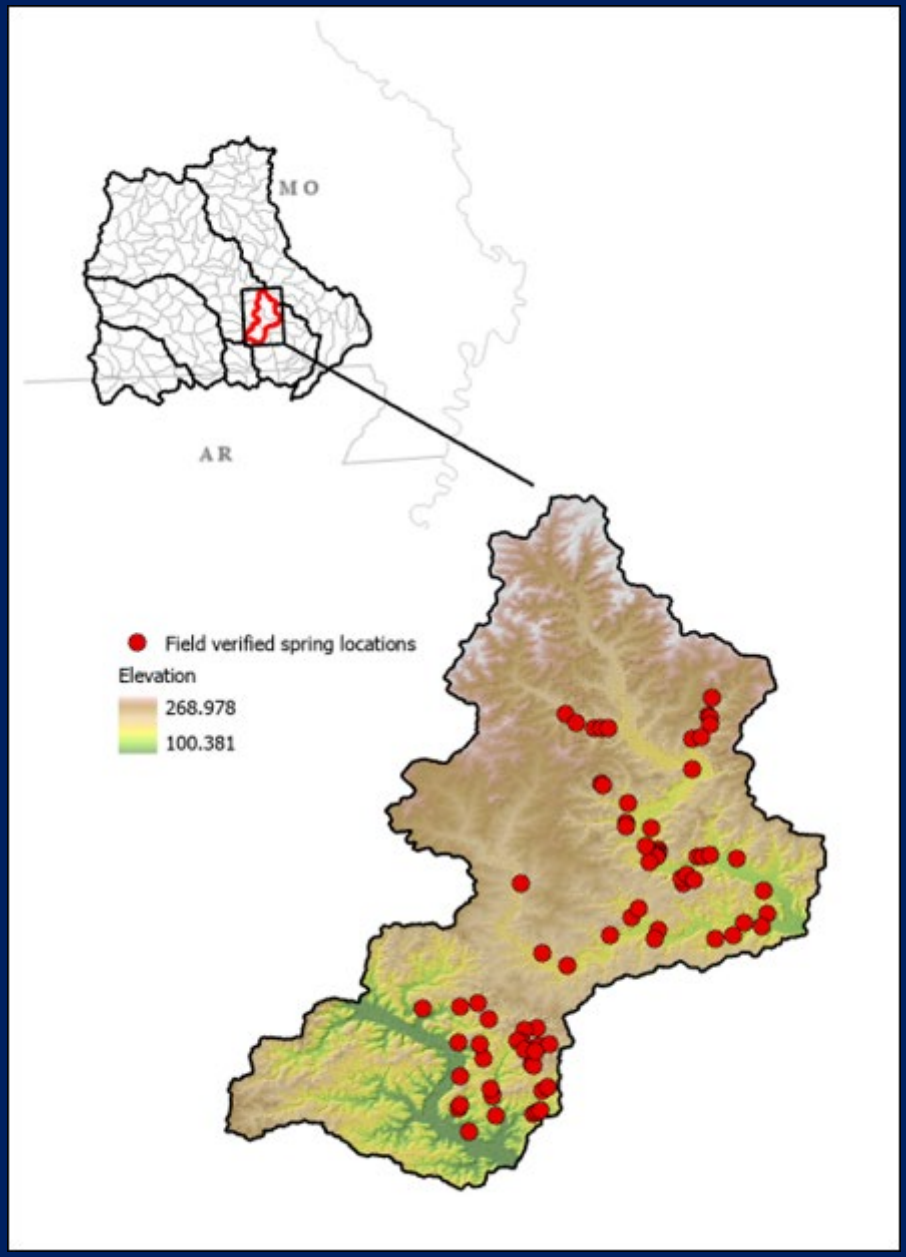
Logical Consistency Between Datasets

- Watersheds (WBD)
  - Process revised boundaries early
  - Eliminate time revisiting extents - NWI and CCAP
- EDH and NWI
  - Source data requirements
  - EDH lines contained within NWI polygons
  - Flowlines forming the edges of wetland features
  - Conduct full hydro-enforcement as an initial step
  - Cost savings of up to 20% in NWI data production
- NWI and C-CAP Consistency
  - Enforce vegetation breaks from NWI in C-CAP
  - Utilize NWI wetlands as C-CAP wetlands

MaxEnt Machine Learning Algorithm GDE Landscapes

Predictor Variable	Description
fws	flow weighted slope
profcurv	profile curvature
plancurv	planform curvature
tancurv	tangential curvature
casocurv	Casorati curvature
torsion	contour geodesic torsion
tri	terrain ruggedness index
tpi	topographic position index
vrm	vector ruggedness measure
strdens	stream density
strdist	distance from stream
spi	stream power index
slp	slope
hand	height above nearest drainage
dem	elevation
twi	topographic wetness index

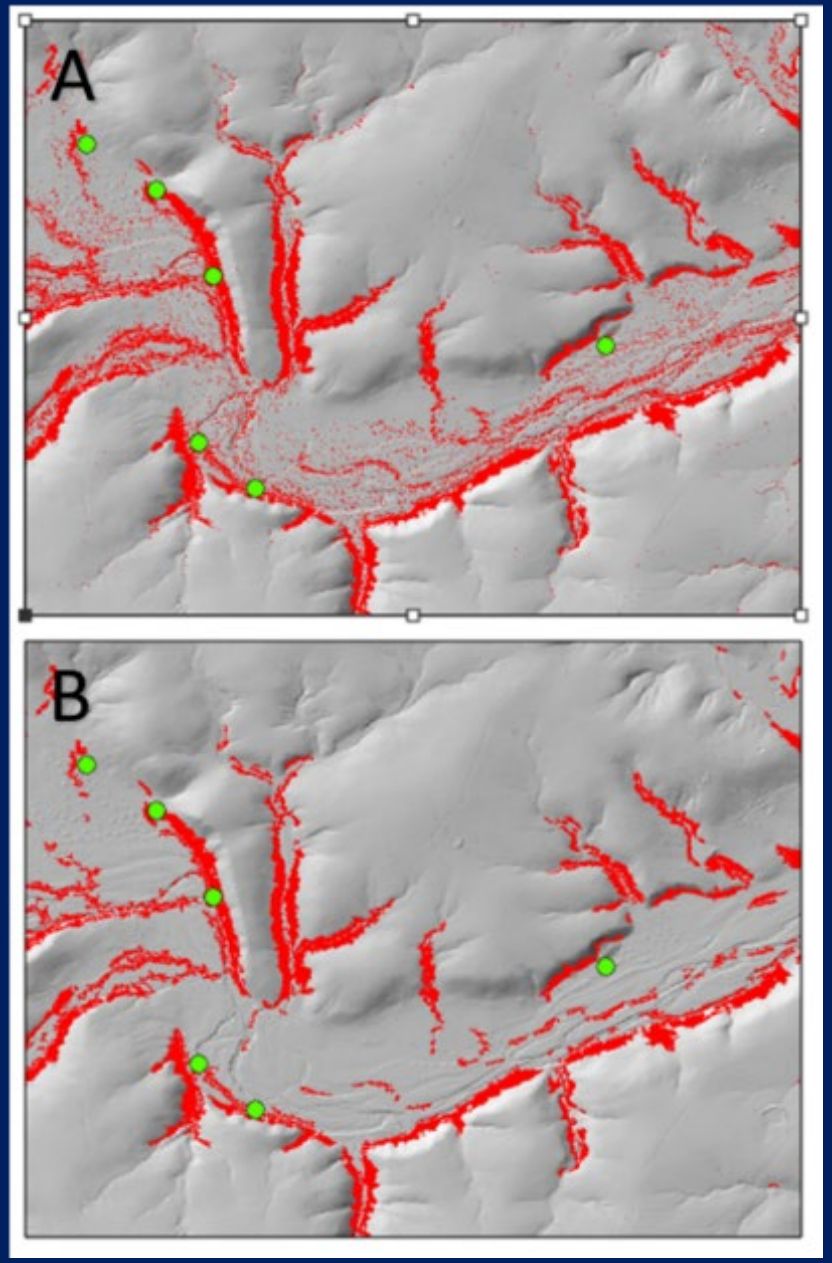


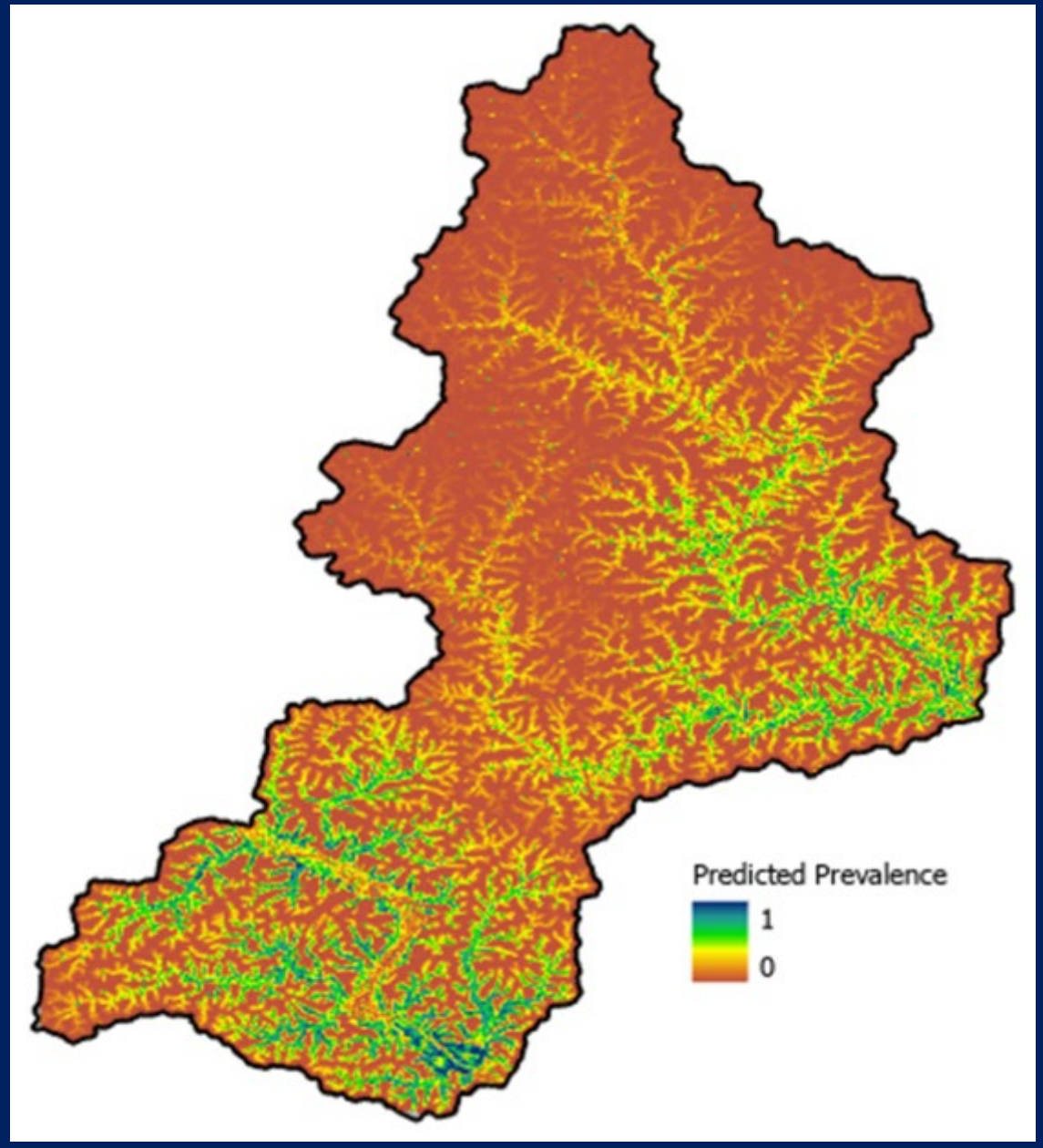


Saint Mary's University
GEOSPATIAL SERVICES

Missouri Springs and Seeps Model

Results





Saint Mary's University
GEOSPATIAL SERVICES

Missouri Springs and Seeps Model

Andy Robertson
Executive Director
GeoSpatial Services
Saint Mary's University
aroberts@smumn.edu
507-457-8746

Saint Mary's University
GEOSPATIAL SERVICES