Ecosystems Services Investments

Florence SCARC

October 2019

Charles Mondello, CEO ESI

Joan Mondello, Chief Strategist ESI

ESI

Who is ESI?

Data Ecosystem Community

- **We enable communities to better manage their infrastructure**
- **What's in a Name**
  - An "investment" in "the ecosystem" returns high value community "services"
  - We focus on areas affecting primarily water, flood, and fire risk
  - Ecosystems Services Investments isn't a banking firm
- **We use**
  - Imaging Science to See
  - GIS to Analyze
  - Web browsers to make Accessible to all
- A trusted team with over 100 years of environmental geospatial experience

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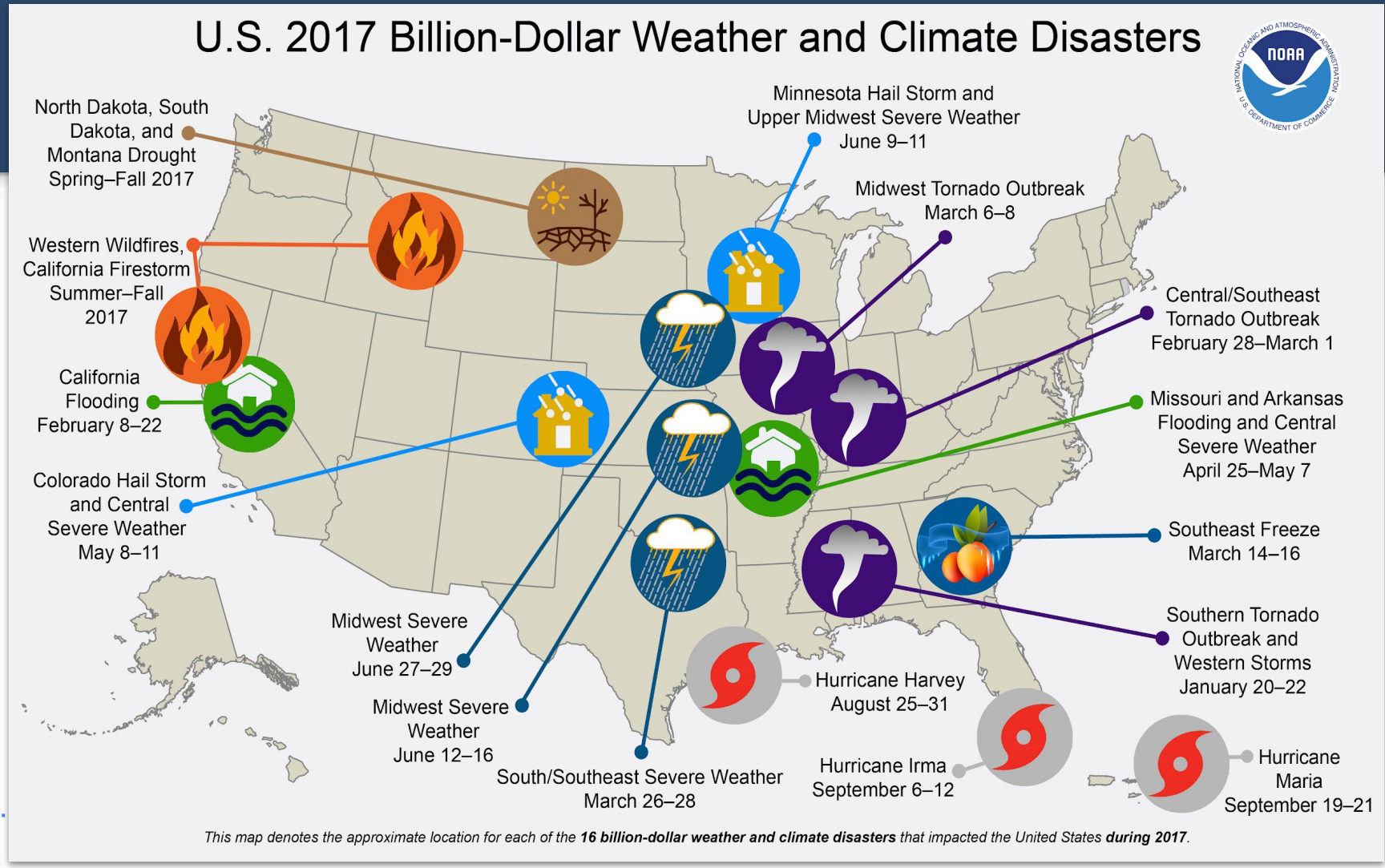
Living Concurrent Once-in-a-Lifetime Events

- Reacting not planning
- Gov't & Commercial risk
- Design impacts on stormwater risk
- ESI provides:
  - Easy-to-acquire data
  - Risk reduction
  - Life safety
  - Timely data



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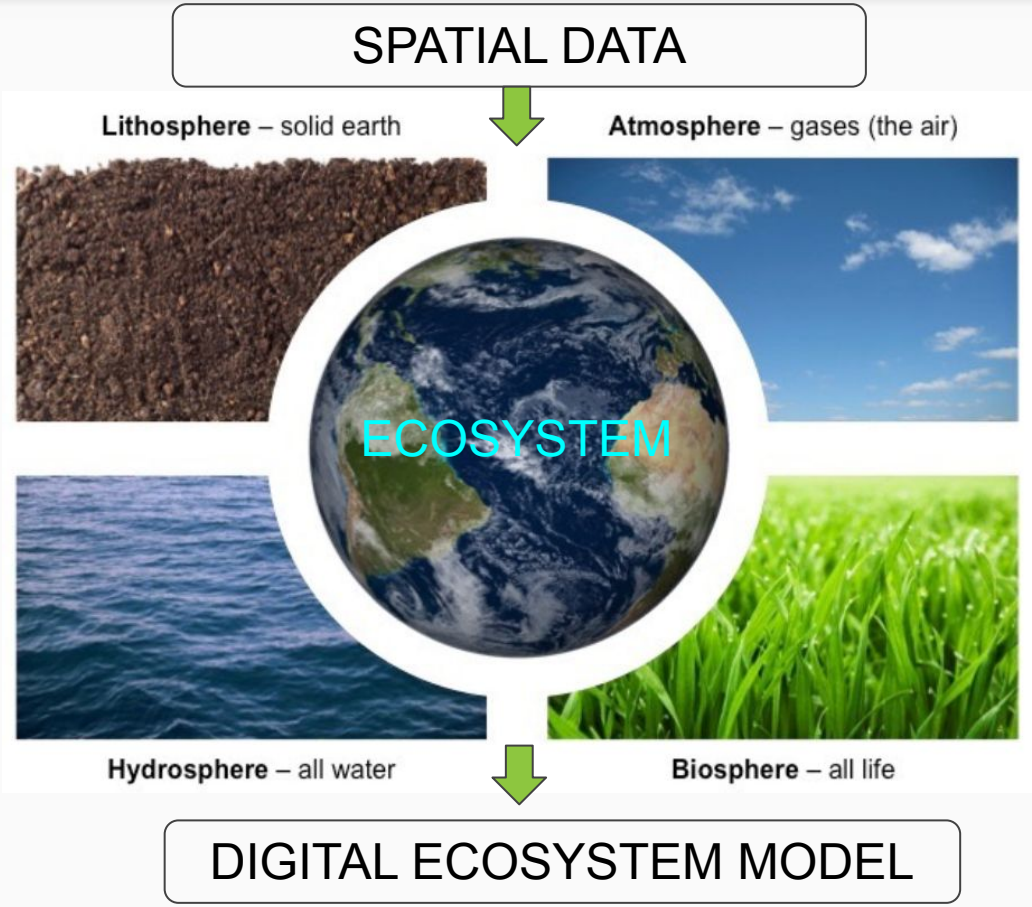
Ecosystem Underpinnings

Allows you to calculate the work the natural system contributes

“Ecosystem Services”

- Flood control
- Stormwater management
- Wildfire management



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What ESI Accomplishes for its Clients

Builds a "living" digital analytic of environmental characteristics

- Identifies technical source data
- Streams data from its source into the analytic
- Conducts quality control on the data
- Populates engineering algorithms with the data
- Develops an internet portal for user browser access
- Can run "what if" scenarios as often as required
- Enabling a near real-time visualization for clients

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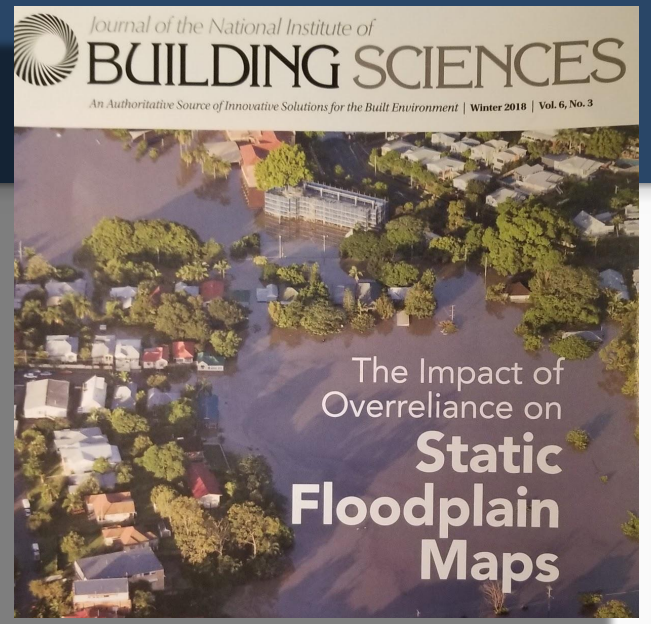
Why Dynamic Analytics are Required

- Our world isn't static
- The environment is changing
- Data cannot be static
- Data needs to be fused from multiple sources
- ESI cloud-based imaging science addresses this



"The satellite imaging can be used to quickly estimate the drought level or soil moisture content level in a particular area."

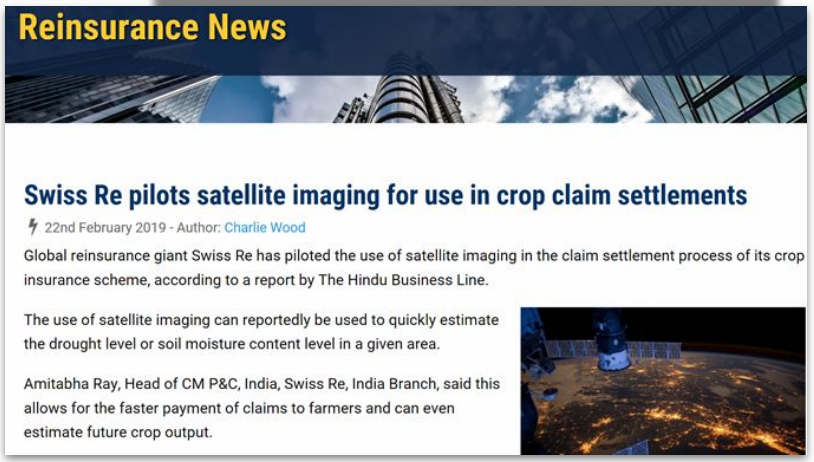
By Verdict Staff February 25, 2019

Swiss Re, a Zurich-based reinsurance company, has trialed satellite imaging to improve claim settlement process in crop insurance scheme.

The reinsurer has already completed a pilot project with the Maharashtra government in India.

Swiss Re India branch head of CM P&C was quoted by The Hindu Business Line as saying: "One example of the new technology we have brought into the country is in the agriculture sector. Satellite imaging is quite powerful these days.

The satellite imaging can be used to quickly estimate the drought level or soil moisture content level in a particular area.



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Who is ESI? A trusted team who worked together for decades

Charles Mondello

CEO
-Fortune 500-Startup
-Federal Government
-Pres/CTO/VP Sales/Dev
-30 years in geospatial
-ASPRS Fellow
-Imaging Science BS/MS

Michael Flaxman

CTO
-PhD Geospatial
-MIT, Harvard, ESRI
-30 years in geospatial

Gary Moll

COO
-Urban Forests/Ecology
-40 years Pub, Priv, NGO
-VP American Forests

Karen Edwards

CMO
-25 years MarCom
-Technology/geospatial
-Start-up experience

Joan Mondello

Chief Strategist
-Executive Management
-Imaging Science
-Satellite Systems Design
-Systems Engineering
-Six Sigma Black Belt

Daniel Weismann

Lead Programmer
PhD Lisbon/MIT

Eduardo Pavao

Lead Analyst
BA GIS, Agronomy

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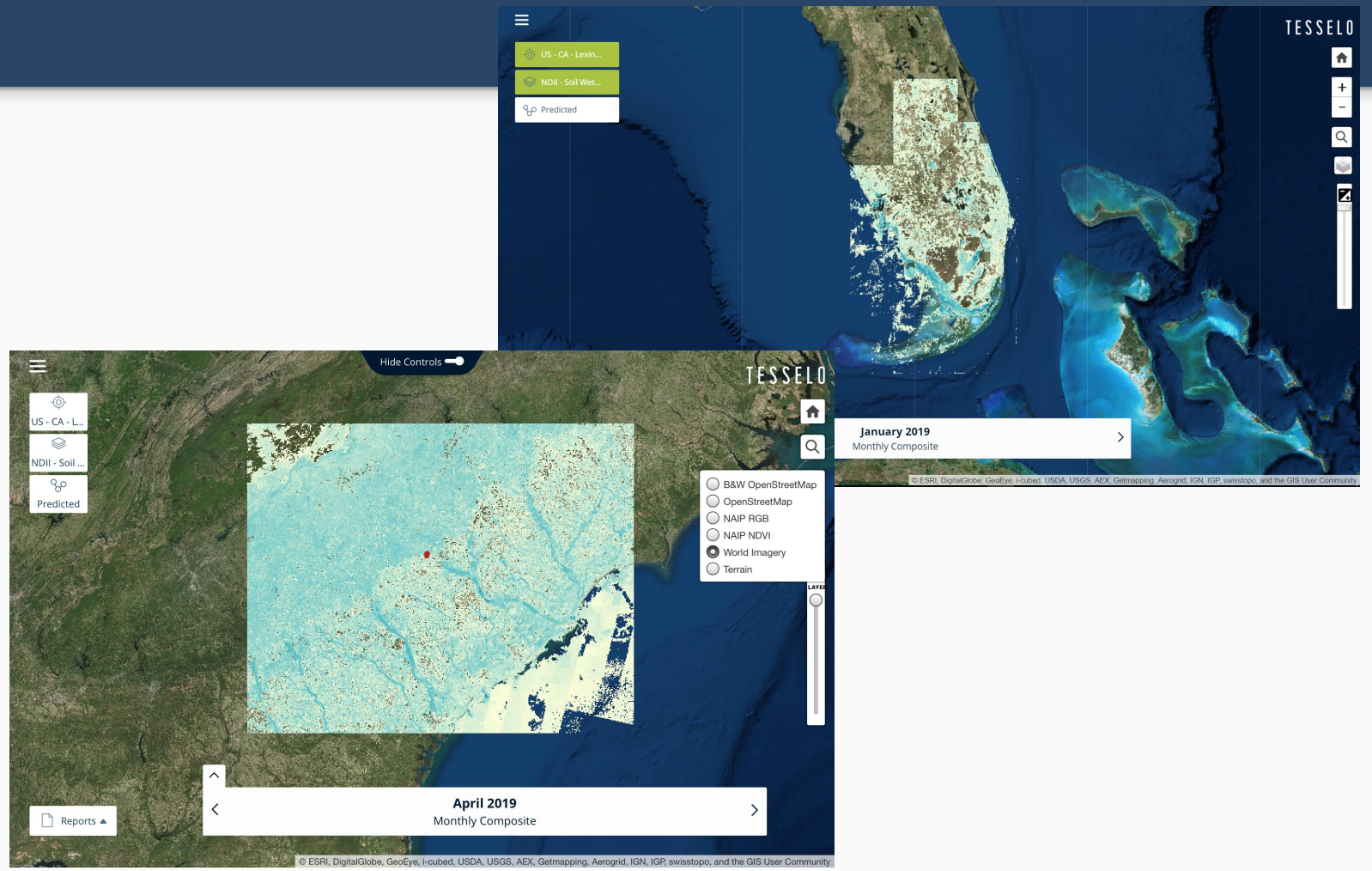
Changes in Remote Sensing

- Technology has changed what we should expect from remote sensing
- Live, near real-time calculations over broad areas are viable
- Cloud-based machine learning artificial intelligence



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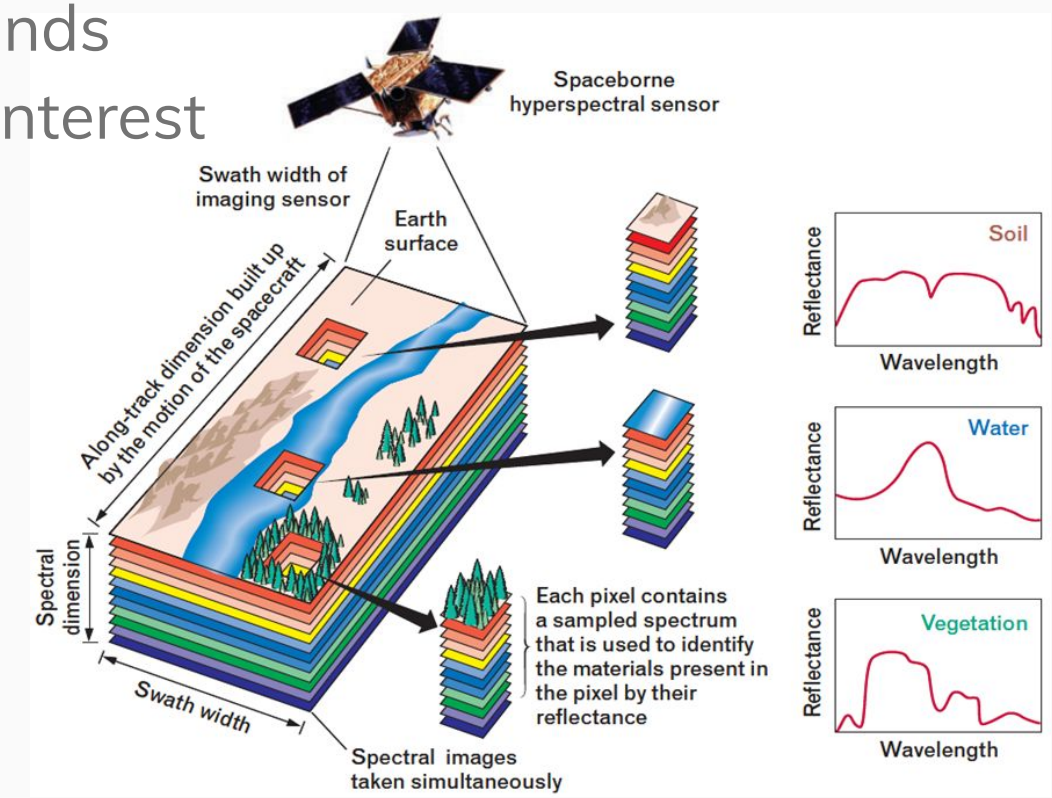
Spectral Radiometric Remote Sensing

- Most data capture is RGB and in some cases Near IR
- Multi and Hyperspectral further segregate bands
- ESI uses bands to best assess the targets of interest

Band	Name	Central wavelength (nm)	Spatial resolution (m)
1	**Aerossol**	**443**	**60**
2	Blue	490	10
3	Green	560	10
4	Red	665	10
5	Red Edge 1	705	20
6	Red Edge 2	740	20
7	Red Edge 3	783	20
8	NIR	842	10
8a	Water-Vapor	865	20
9	**Cirrus**	**945**	**60**
10	**SWIR 1**	**1380**	**60**
11	SWIR 2	1610	20
12	Red Edge 4	2190	20



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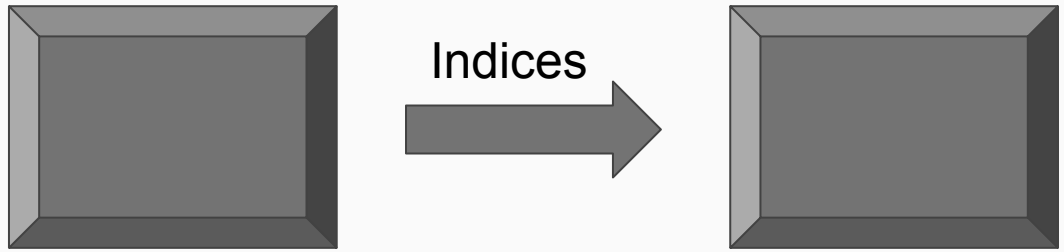
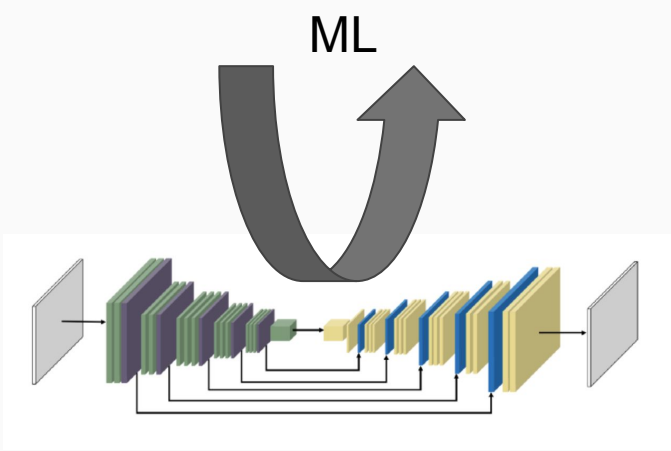
General Workflow

Grab layers from Amazon storage

- For simple cases: process on-the-fly
- For complex cases: preprocess & classify using ML and AI
- Understand spatial spectral relational data components
- Served as WMS
- Produces a PDF report or GIS file





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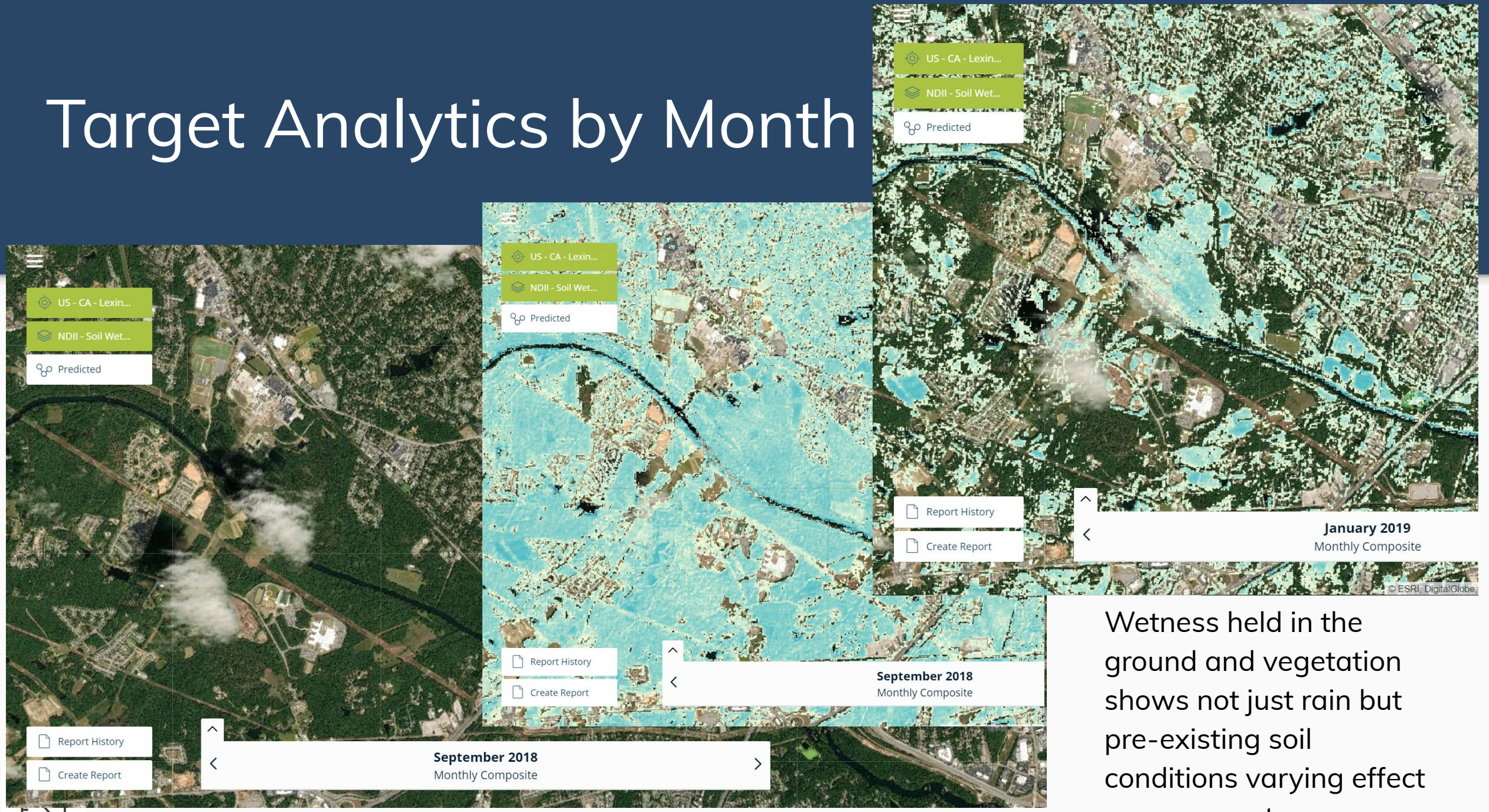
Target Analytics by Month



Wetness held in the ground and vegetation shows not just rain but pre-existing soil conditions varying effect upon property

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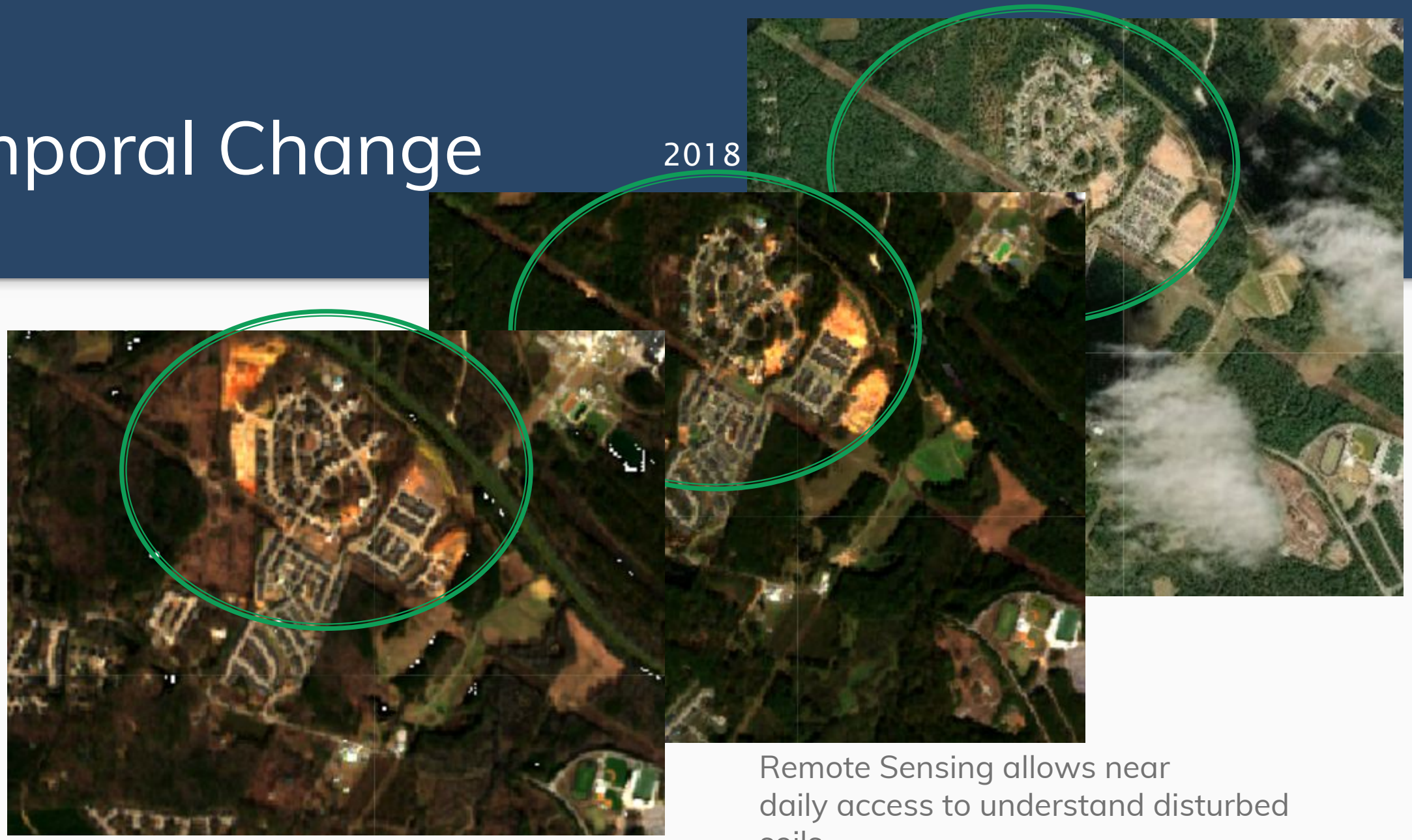
Temporal Change

2018

2019



Remote Sensing allows near daily access to understand disturbed soils

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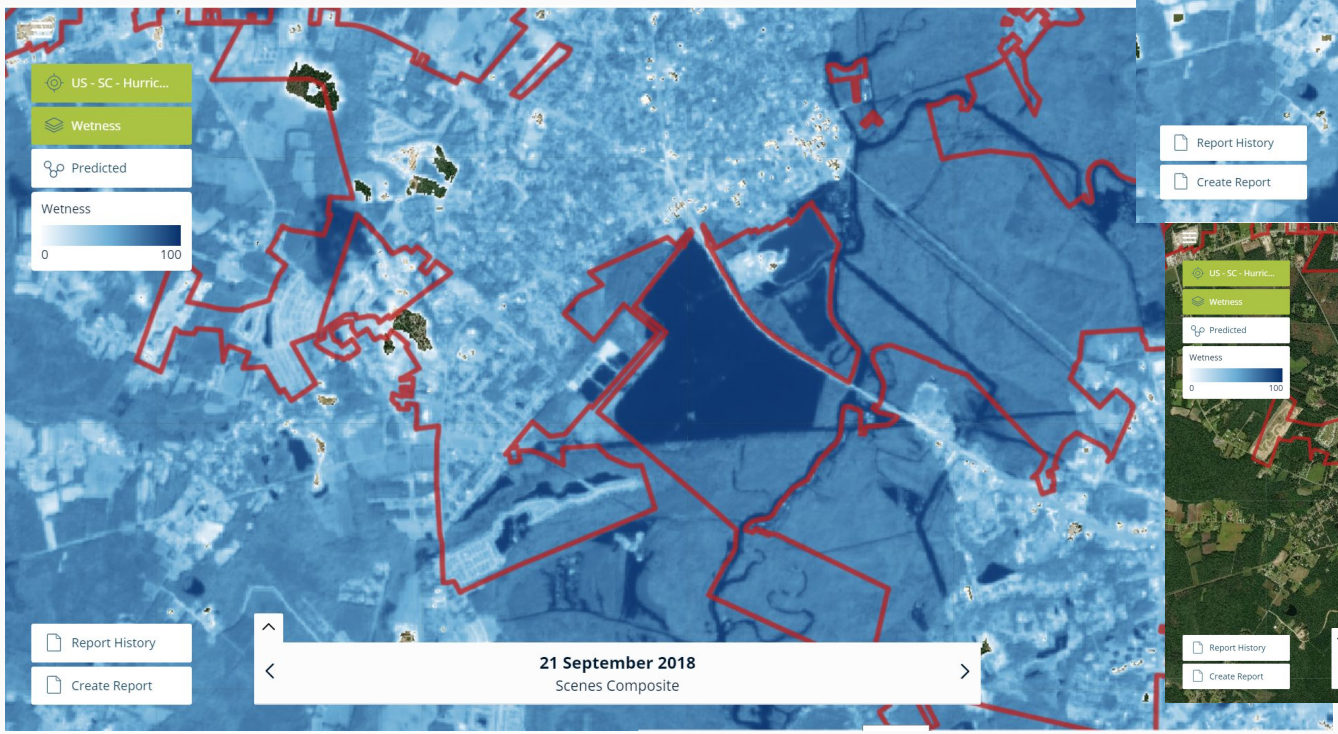
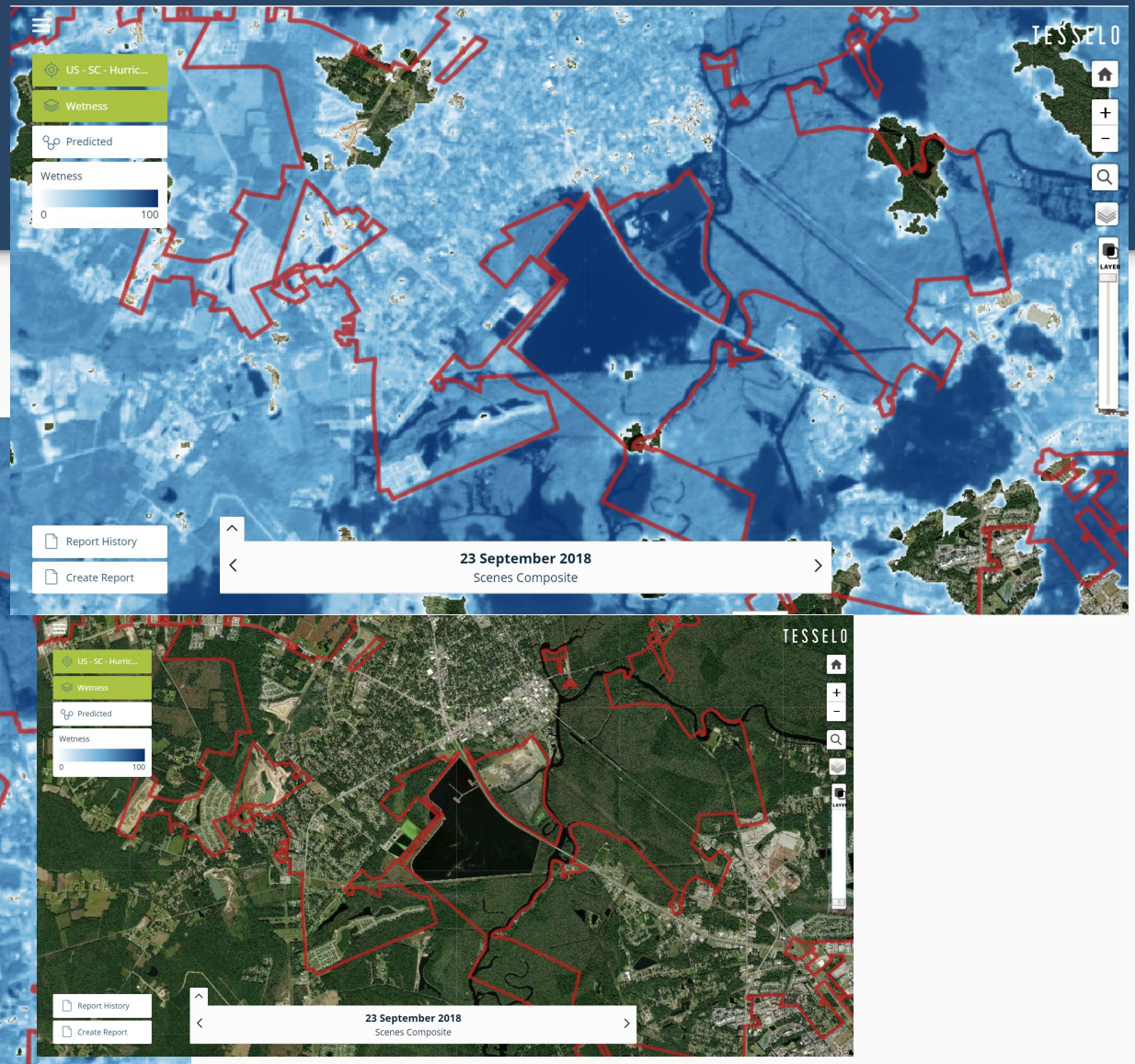
Target Analytics

Surface water mapping can show how an area floods,
Dark blue is standing water





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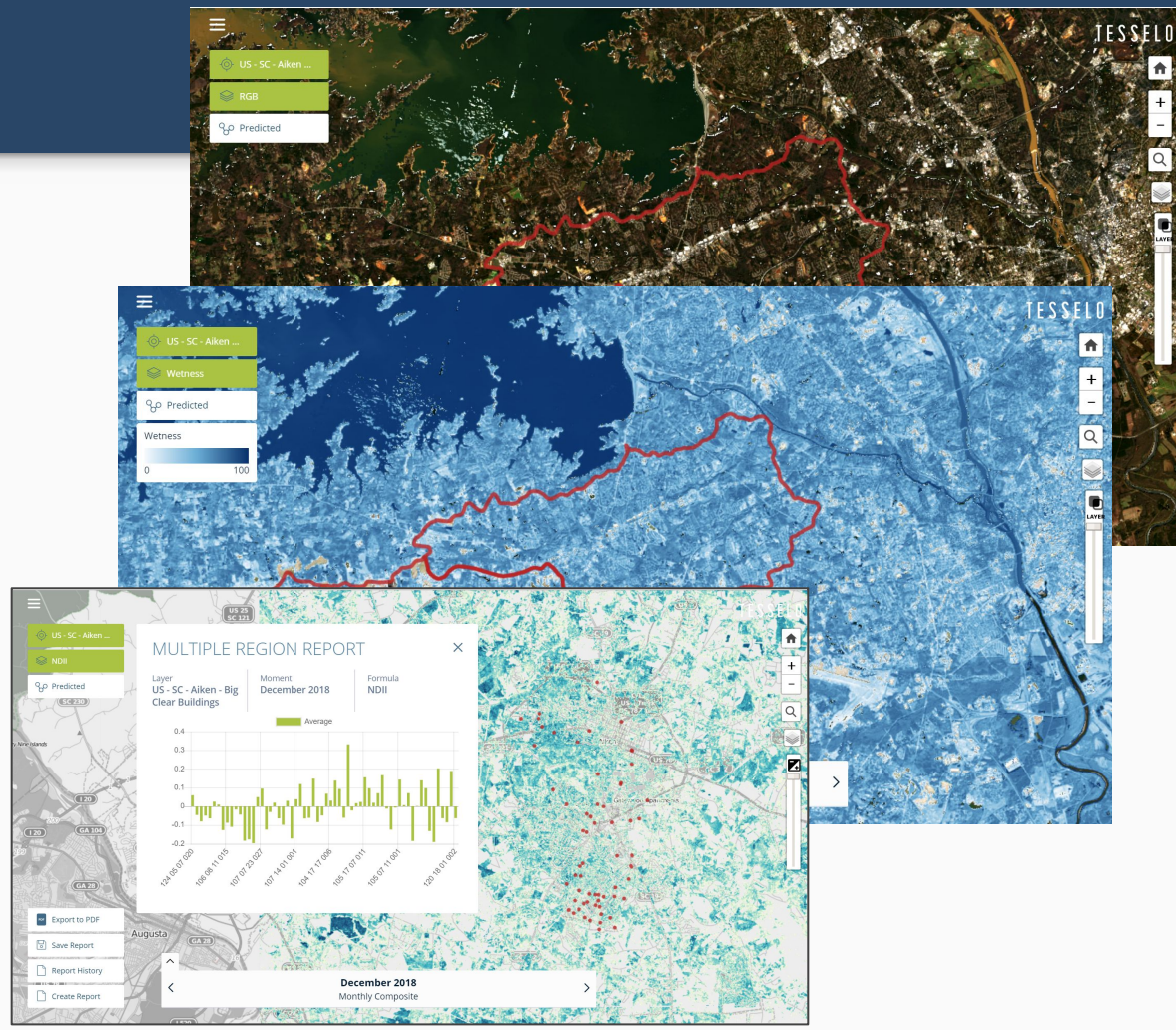
Science, Technology and Action

ESI provides accurate, timely data, and analysis. Instantly and cost effectively

- Instant visualization
- Near live and historic data
  - Flood, Fire
  - Storm management
  - Risk management
- Incorporate data seamlessly into a GIS
- Basic layers can support a common operating picture



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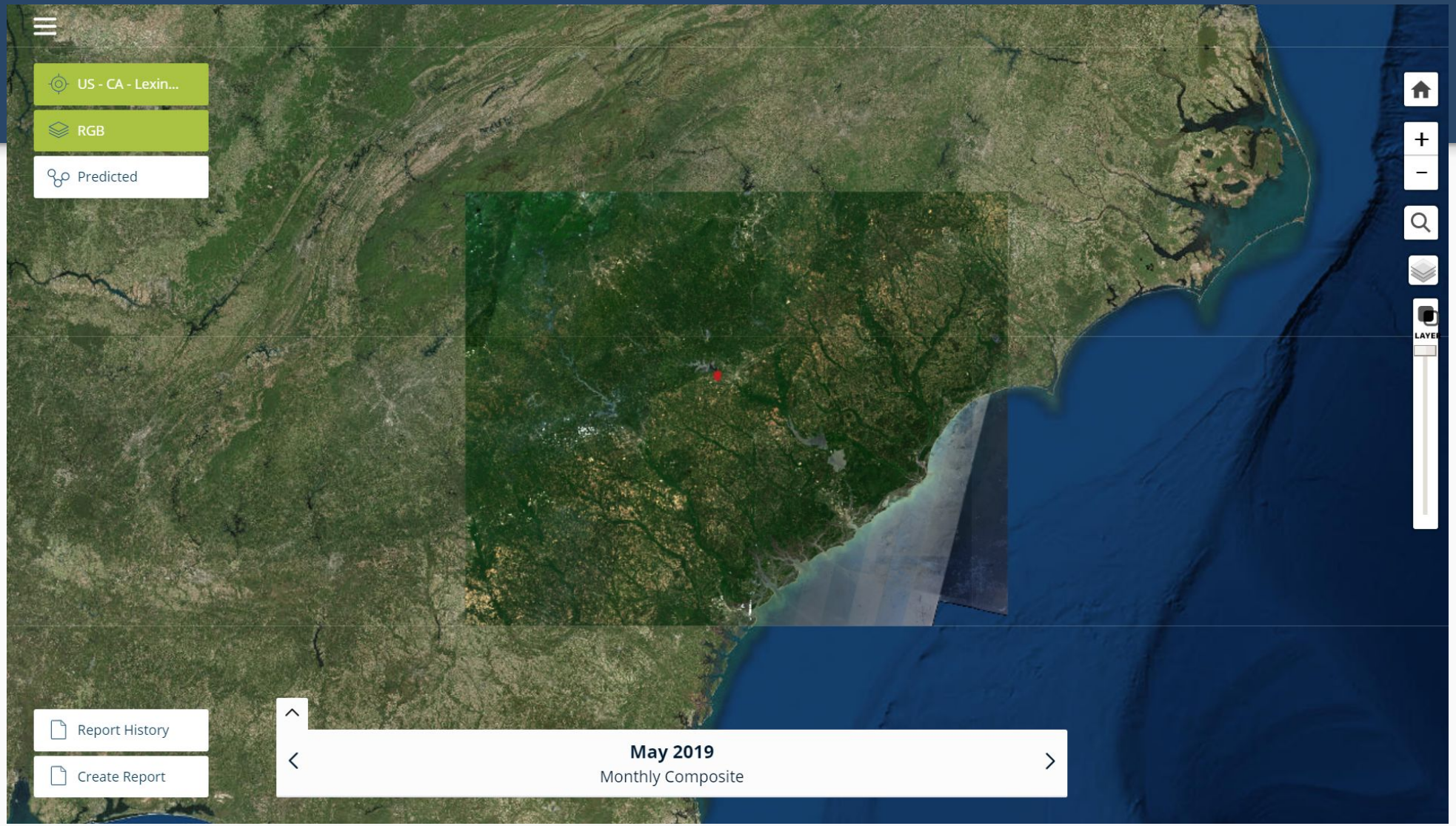
A view of South Carolina May 2019



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A view of Marion County SC May 2019

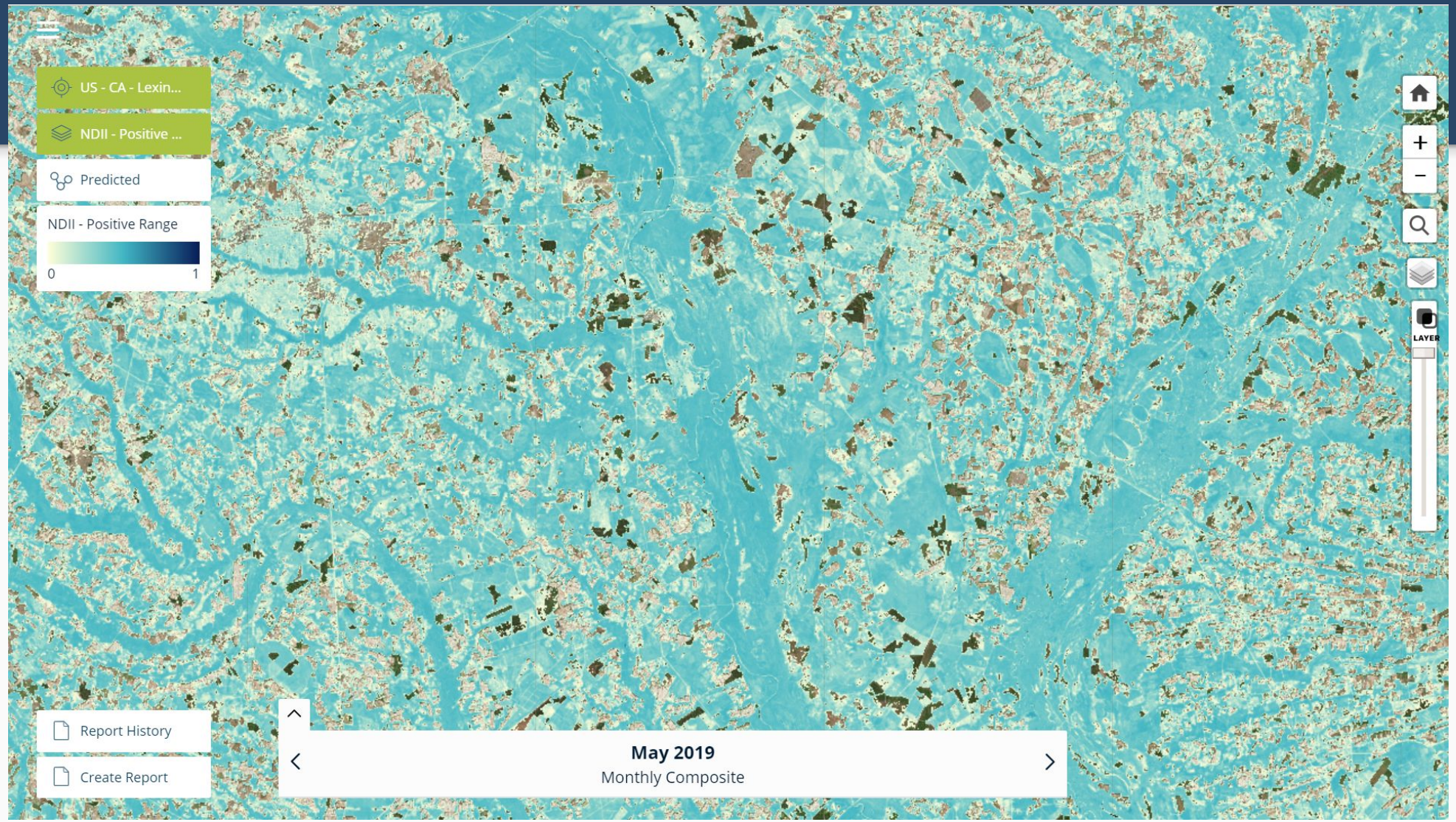
Marion SC

Image shows water and moisture held in the soil and vegetation May 2019

Captured by satellite and processed live in the cloud

Data can be viewed live on a smartphone, PC, or tablet

Data can be as recent as 4 days old



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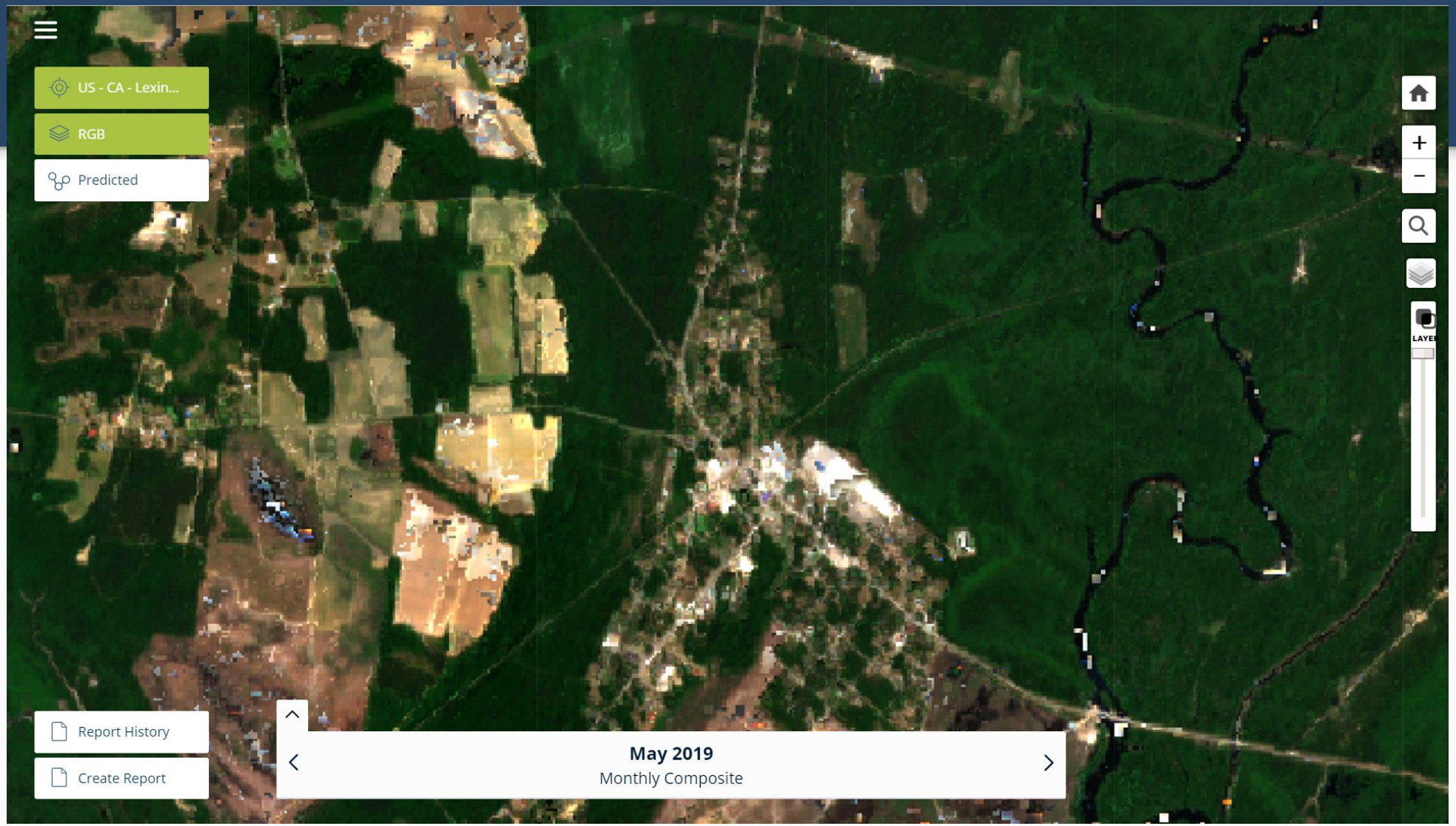
Visualization of natural color data May 2019

Nichols SC

Image shows natural color view useful for context and disturbed soils

Captured by satellite and processed live in the cloud

Data can be as recent as 4 days old



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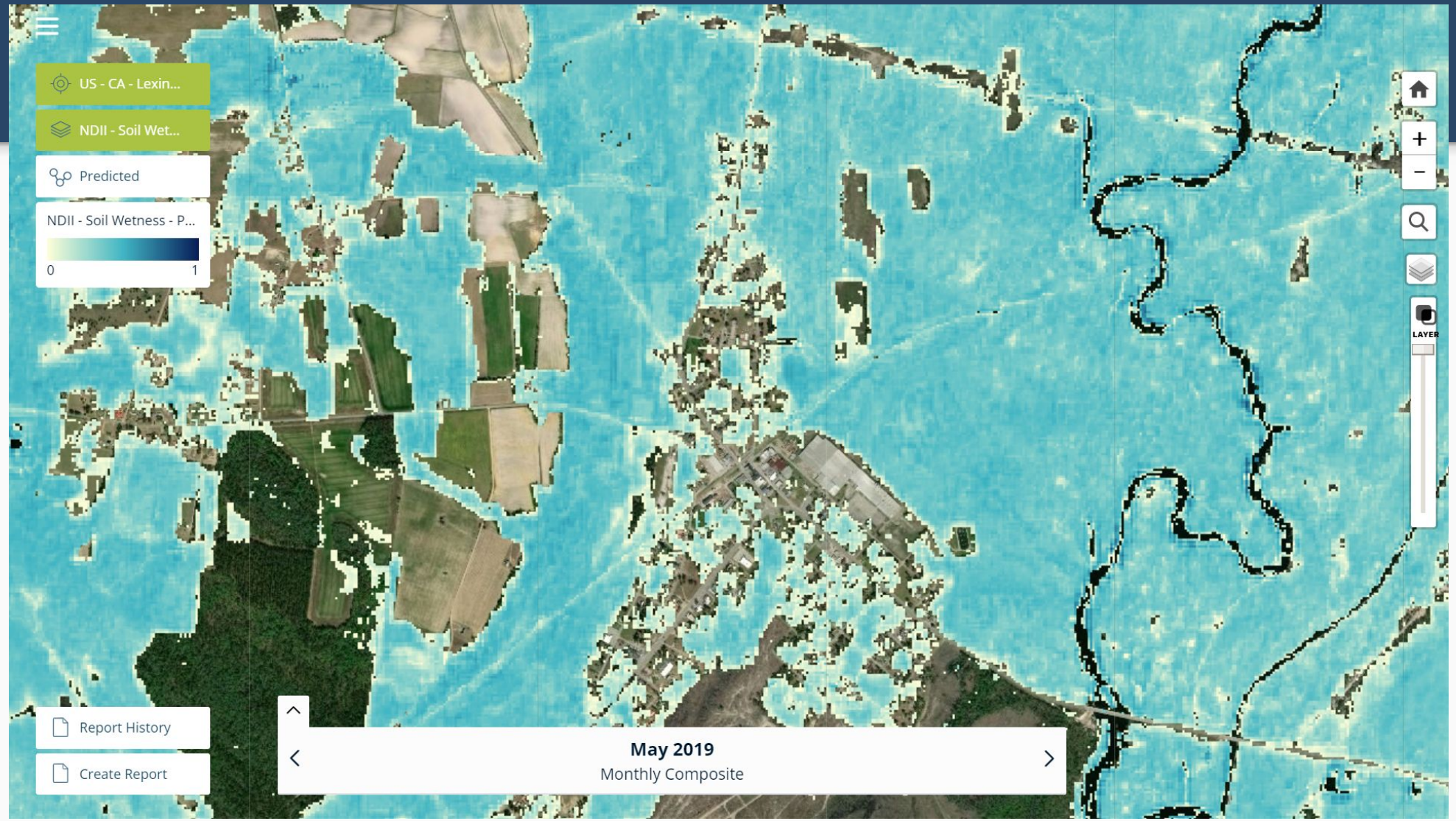
Visualization of water held in soil & vegetation

Nichols SC

Image shows water and moisture held in the soil and vegetation May 2019

Captured by satellite and processed live in the cloud

Data can be as recent as 4 days old



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Visualization of surface water

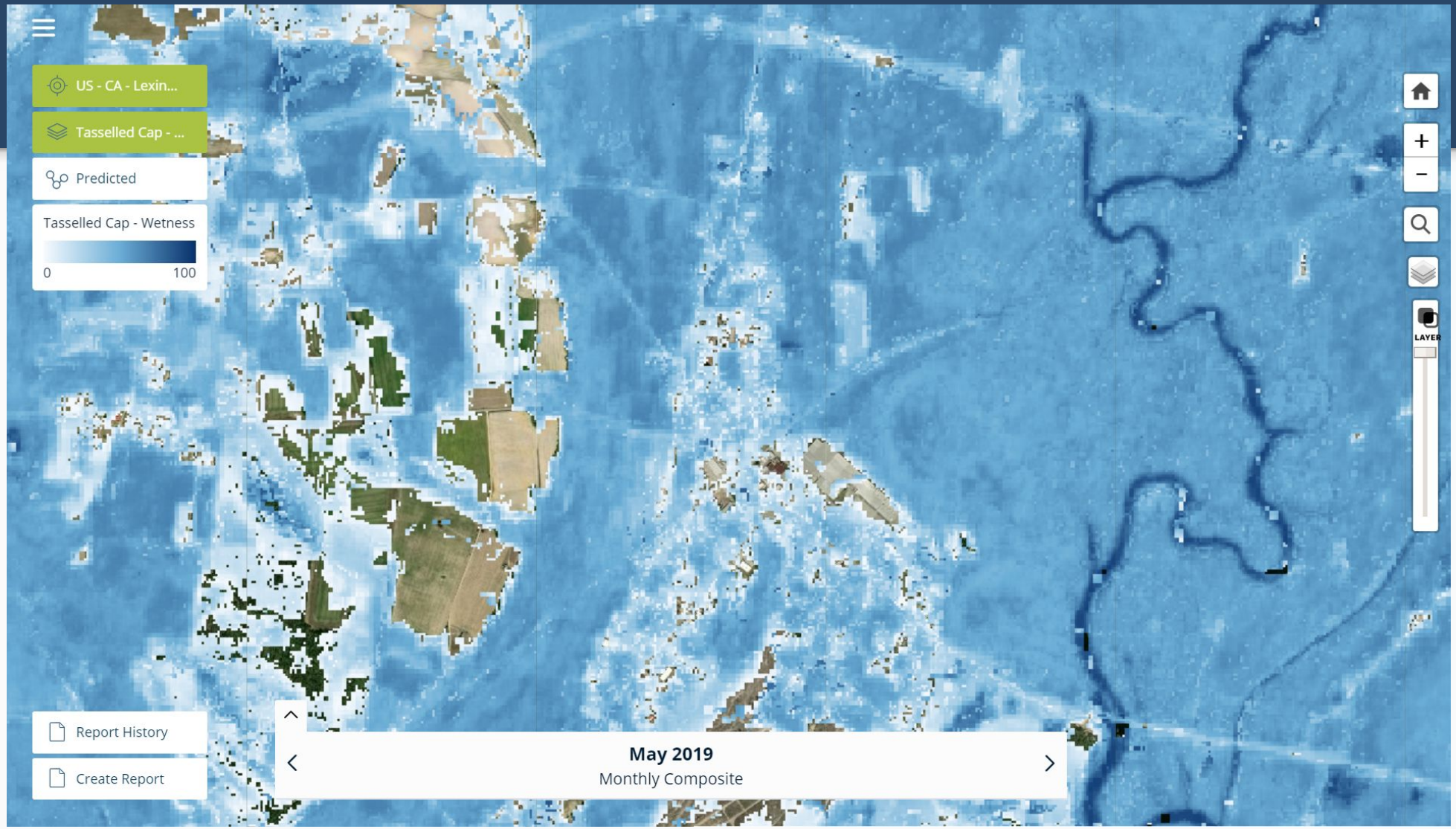
Nichols SC

Image shows surface water and standing water May 2019

Captured by satellite and processed live in the cloud

Dark blue is surface water

Data can be as recent as 4 days old



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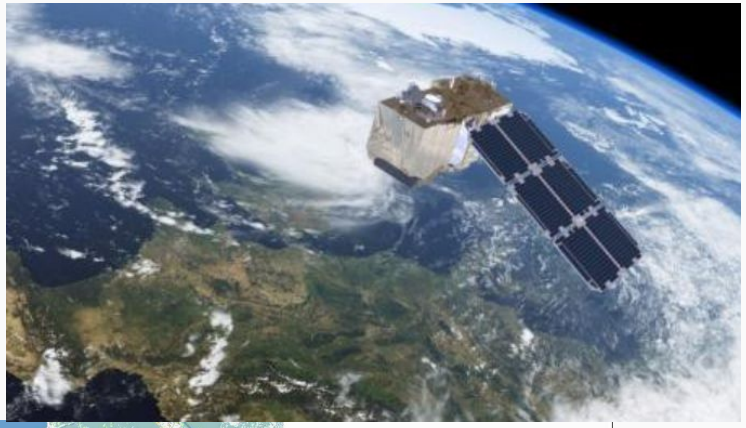
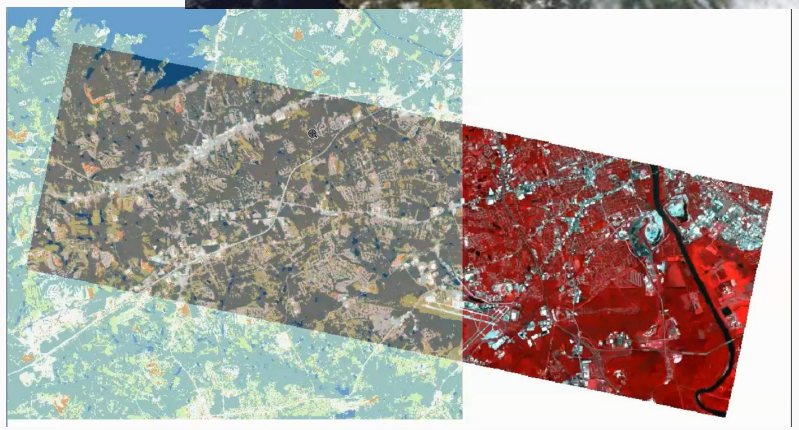
What Our Products Do for You

- Capture and deliver imagery up to every 4 days
  - 10 meter multispectral satellite imagery
  - Clouds removed
  - Mosaiced
- Establish a custom “cloud” portal for our analytic
  - Machine Learning and Artificial Intelligence
- Provide customized GIS layers from the cloud
  - Soil wetness/dryness
  - Standing water
  - Permeable/impermeable





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Ecosystem Services Investments
Visualization Layers of Soil & Leaf Index of Moisture

This series provides visualization of recent monthly images from August 2019 through a sample of past dates

These visualizations provide context from past events to help users plan during current conditions

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Florence Co Visualization

August 2019

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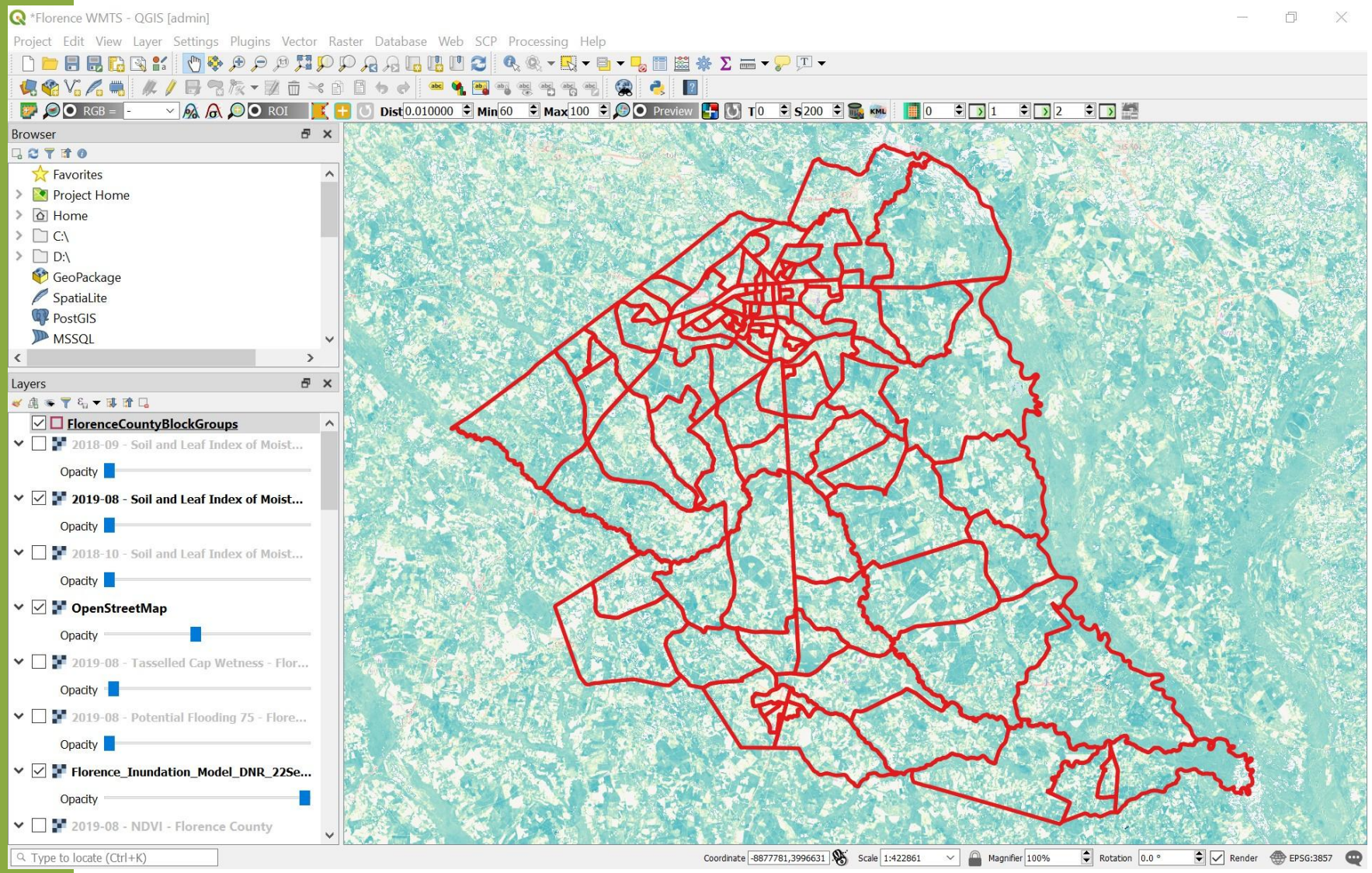
Florence Co

Visualization

Darker greater moisture

August 2019 Image Capture



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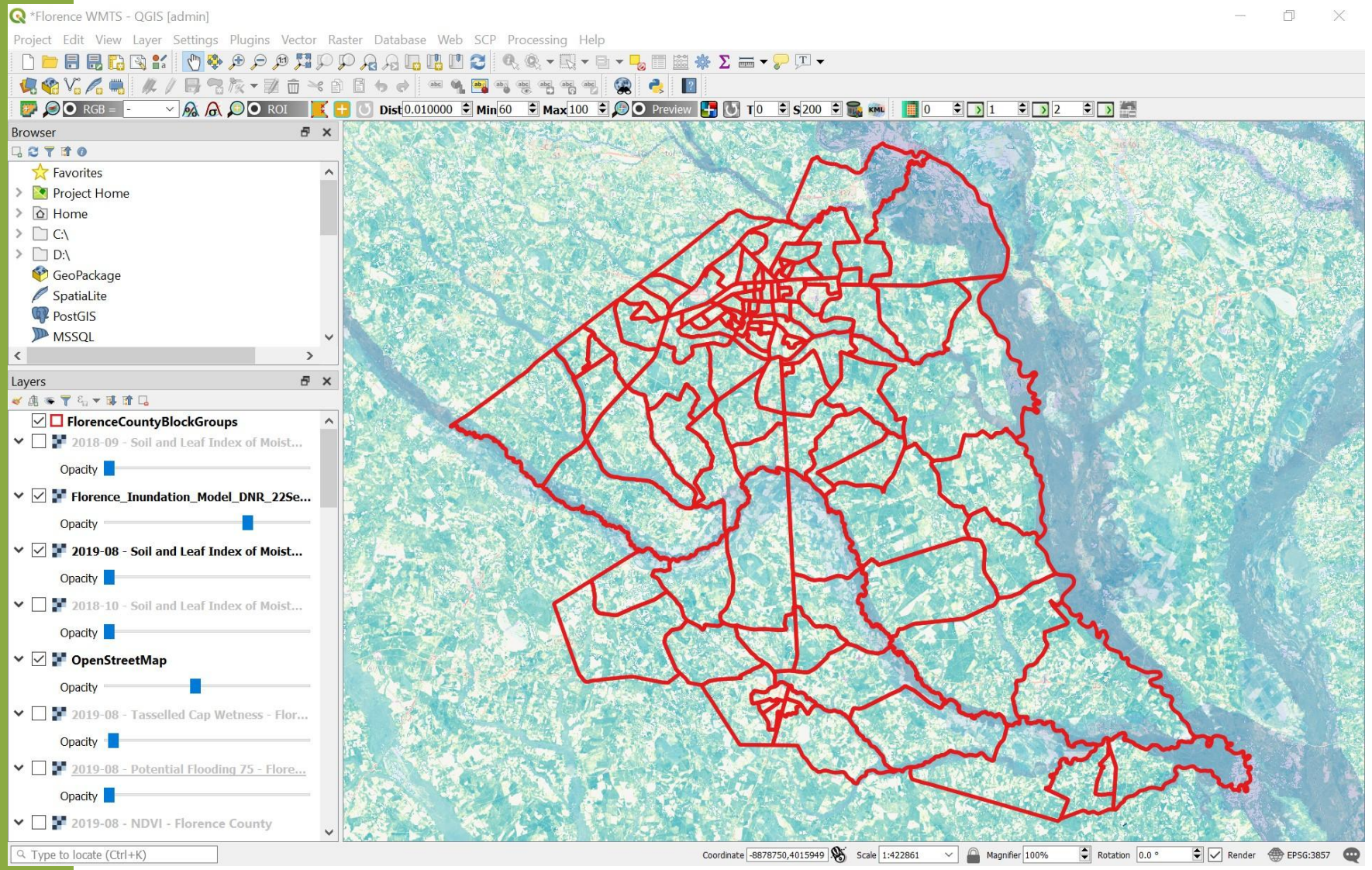
Visualization

Darker greater moisture

August 2019 Image Capture.

SC Inundation Layer



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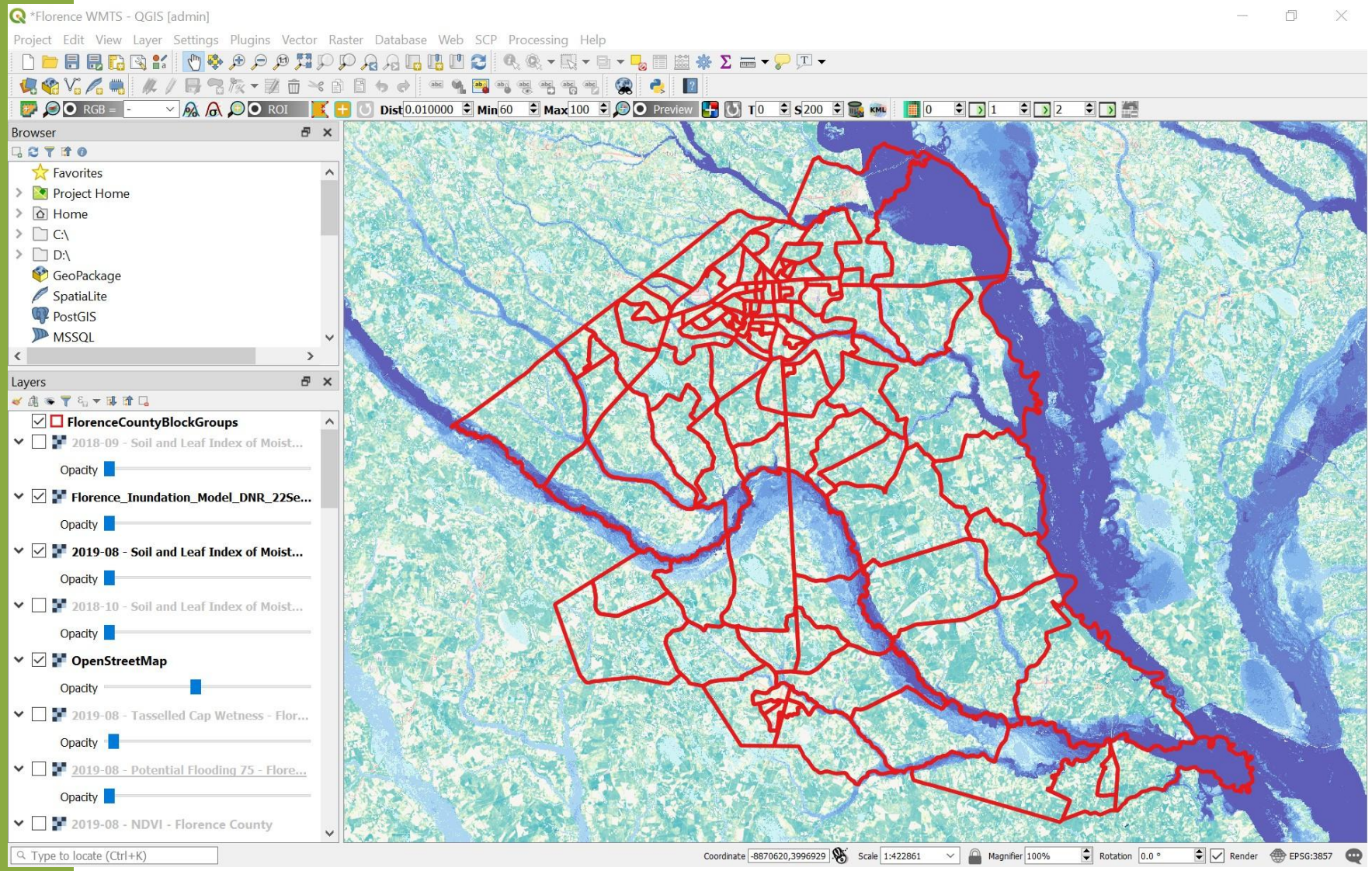
Visualization

Darker greater moisture

August 2019 Image Capture.

SC Inundation Layer



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Region Visualization

August 2019
October 2018
January 2019

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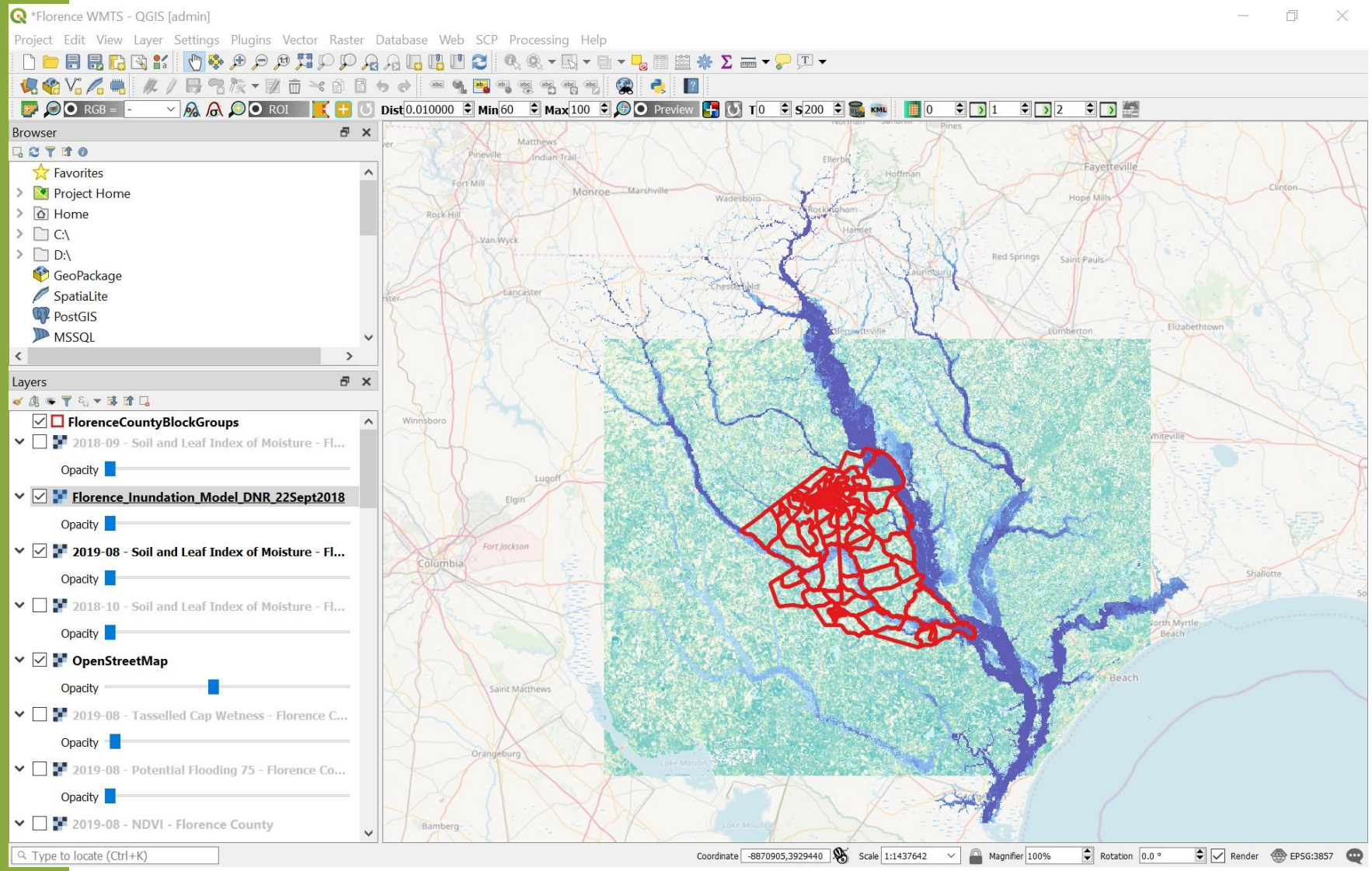
Region

Visualization

Darker greater moisture

August 2019 Image Capture.

SC Inundation Layer Deep blue extent beyond image region



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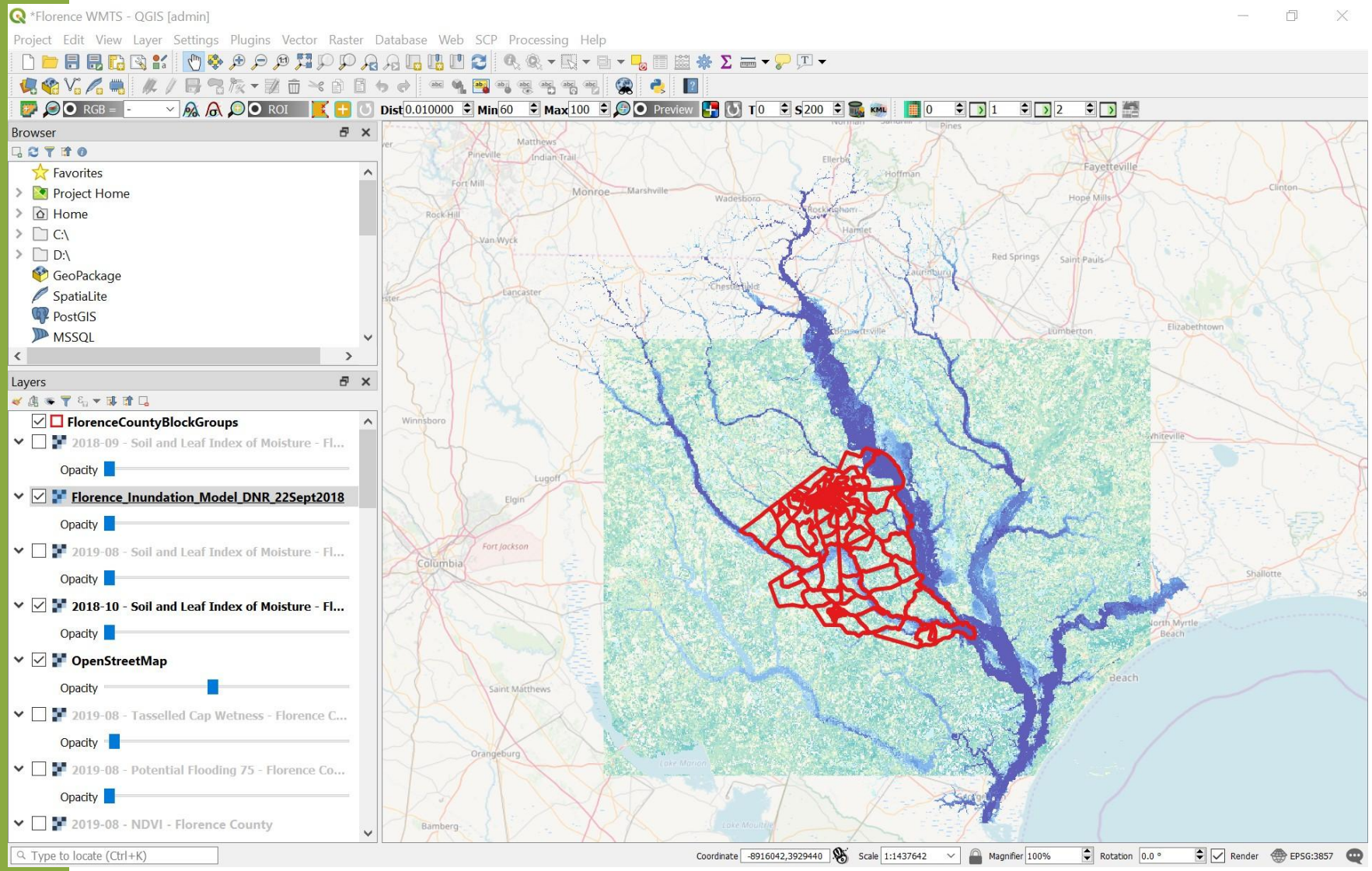
Region

Visualization

Darker greater moisture

October 2018 Image Capture.

SC Inundation Layer Deep blue extent beyond image region



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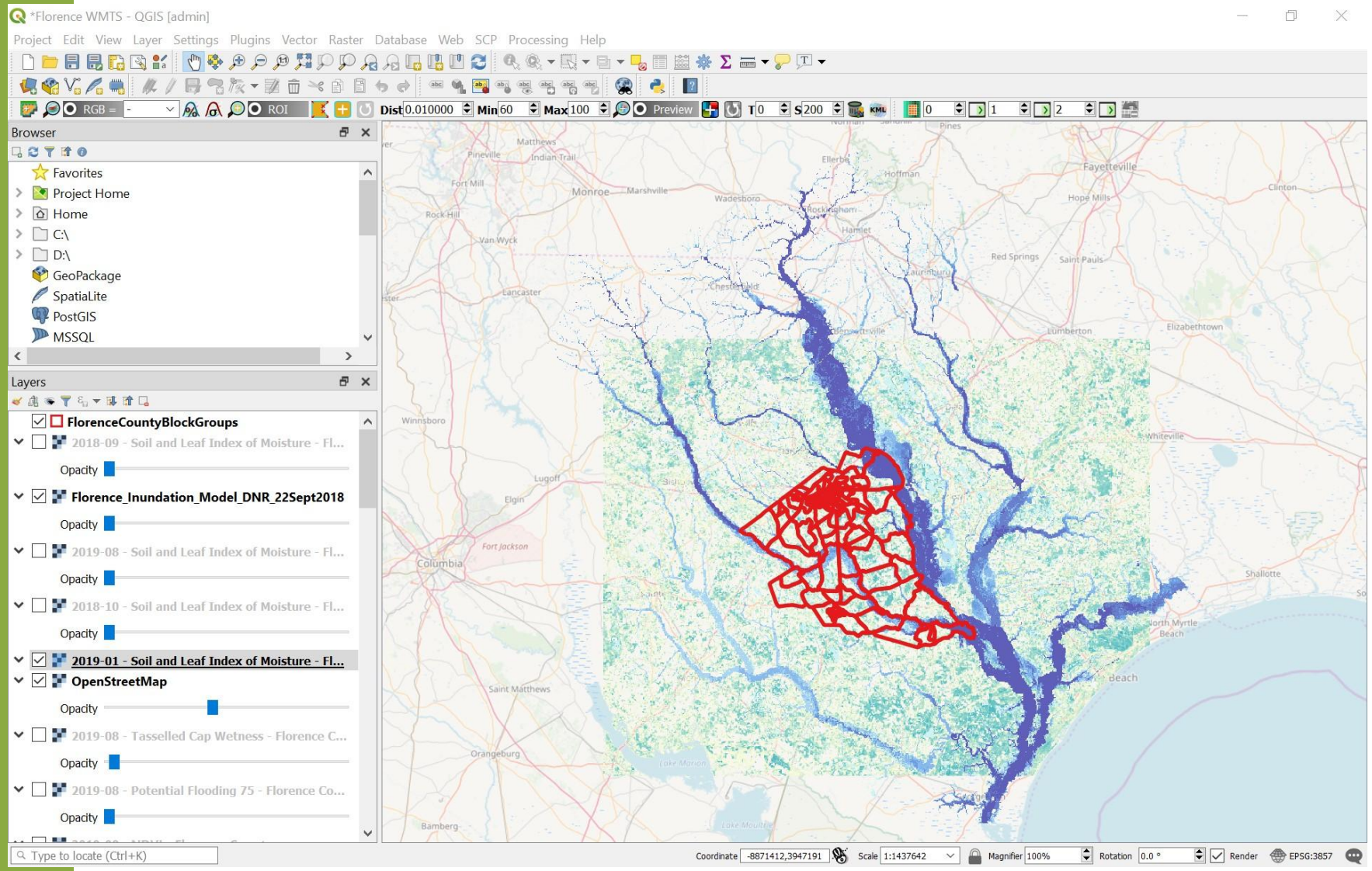
Region

Visualization

Darker greater moisture

January 2019 Image Capture w/ lower retained moisture period

SC Inundation Layer Deep blue extent beyond image region



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Florence Co Comparison Visualization

Sept 2018 vs August 2019

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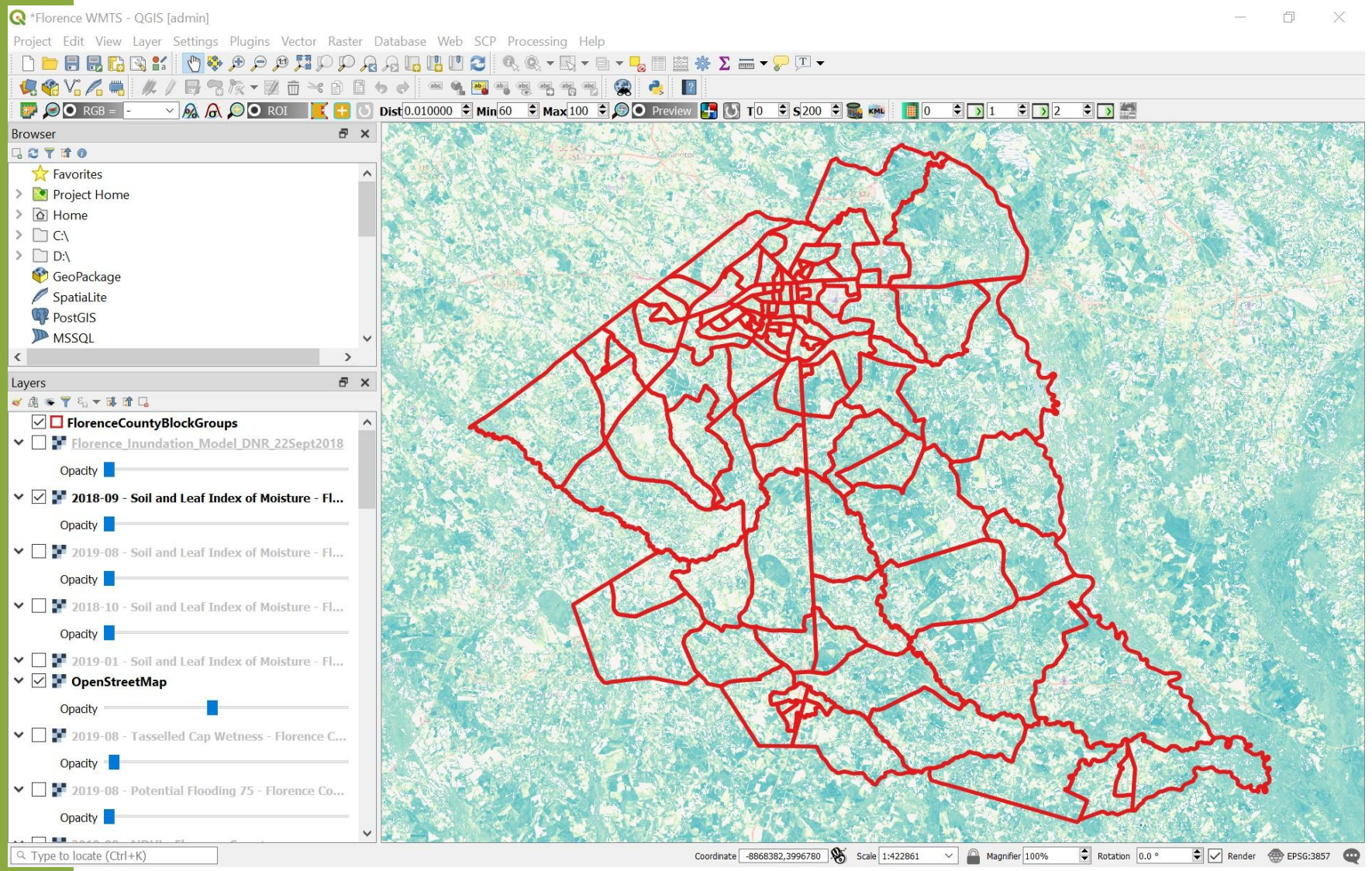
Florence Co

Visualization

Darker greater moisture

September 2018 Image Capture.



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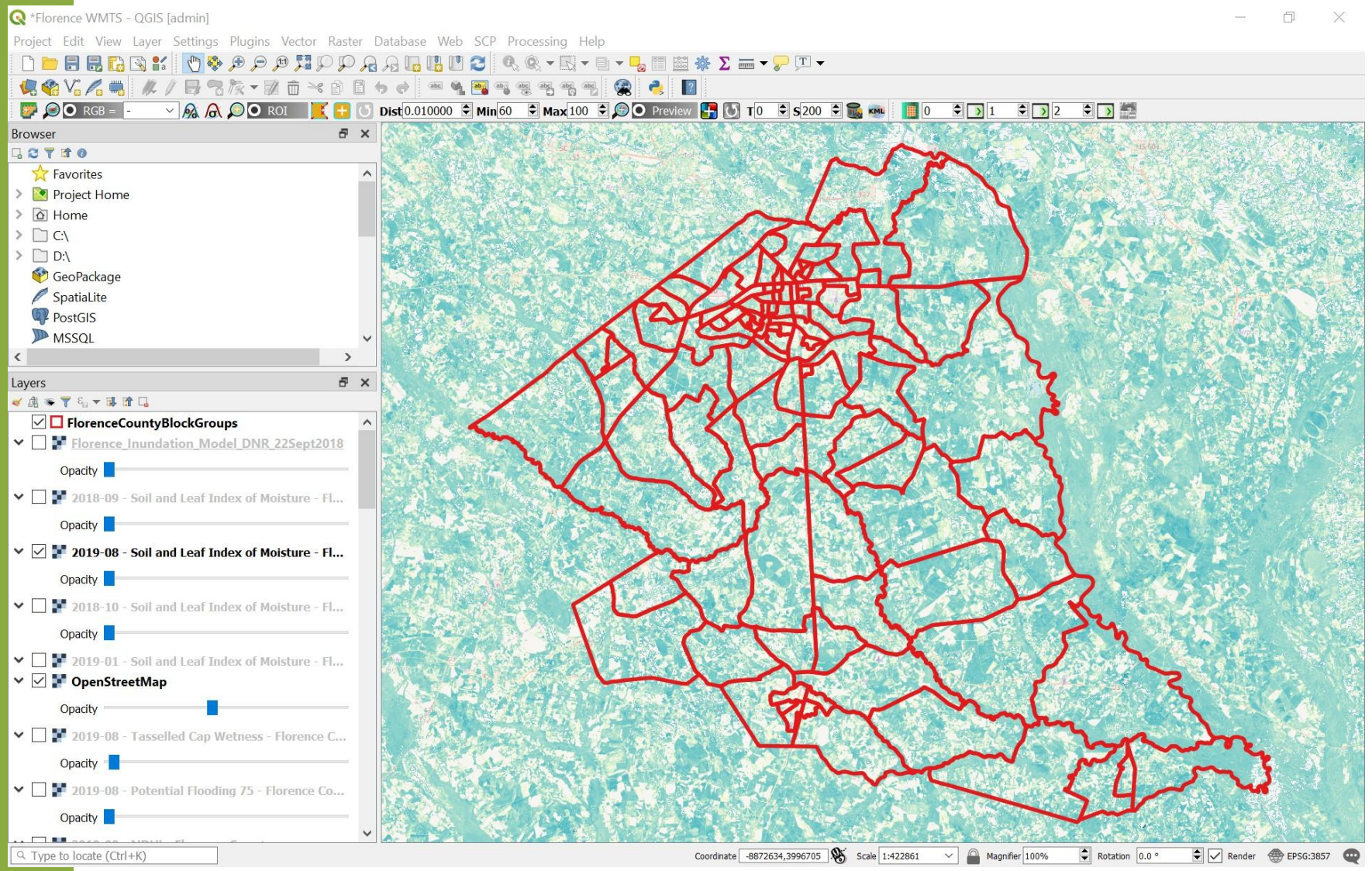
Visualization

Darker greater moisture

August 2019 Image Capture.



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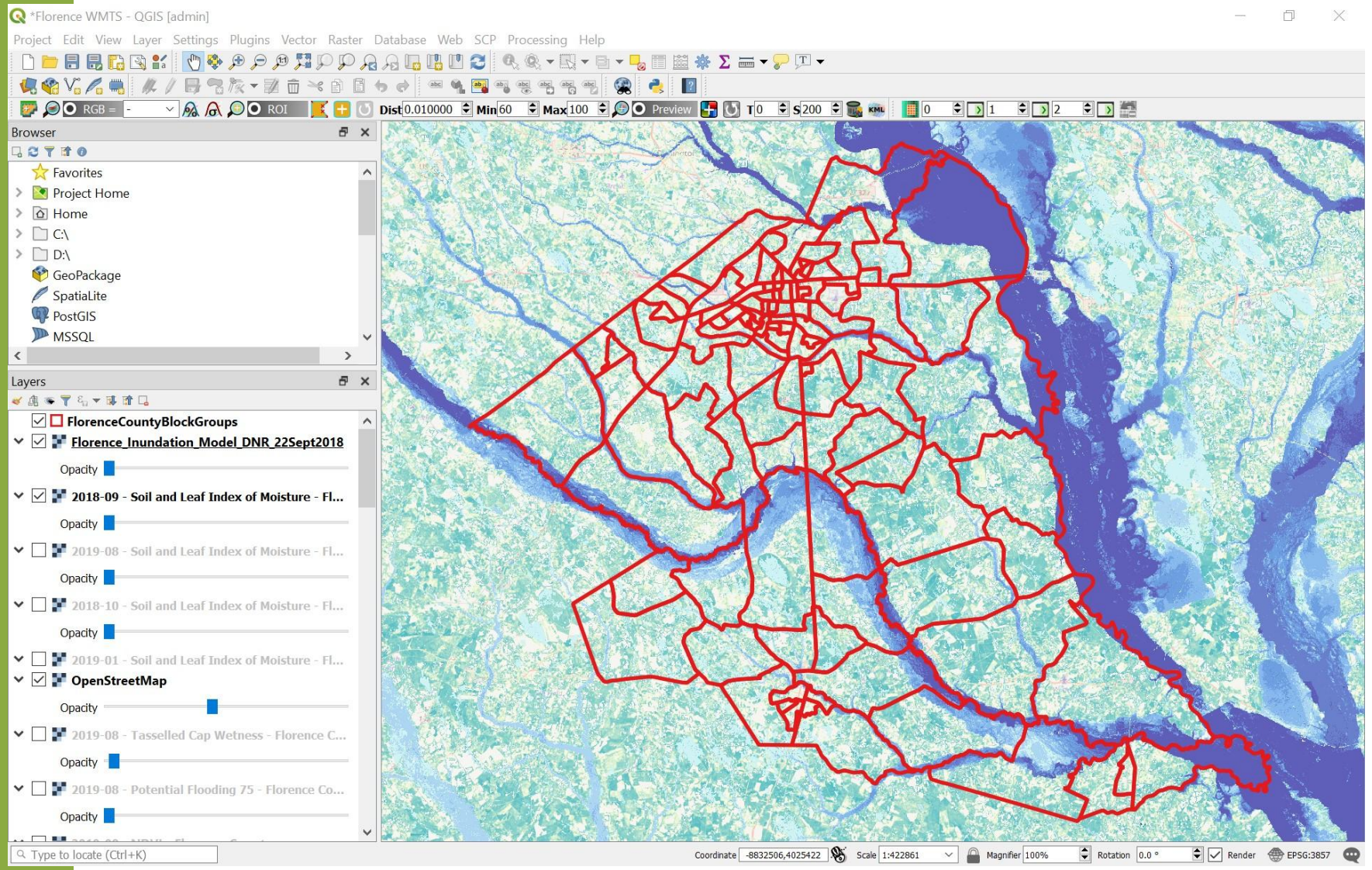
Florence Co

Visualization

Darker greater moisture

September 2018 Image Capture

SC Inundation Layer



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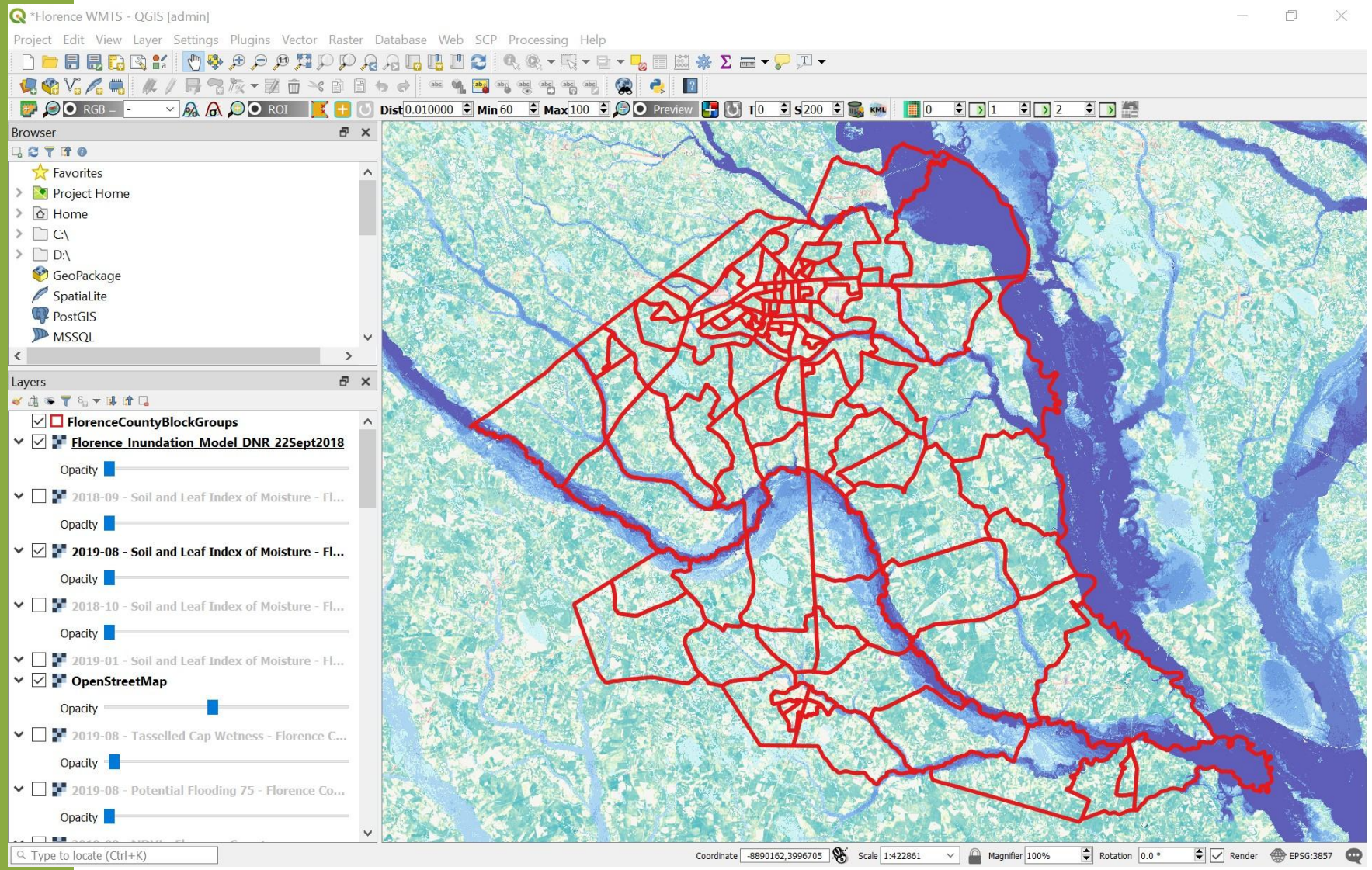
Florence Co

Visualization

Darker greater moisture

August 2019 Image Capture

SC Inundation Layer



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Northern Florence Co Comparison Visualization

Sept 2018 vs August 2019

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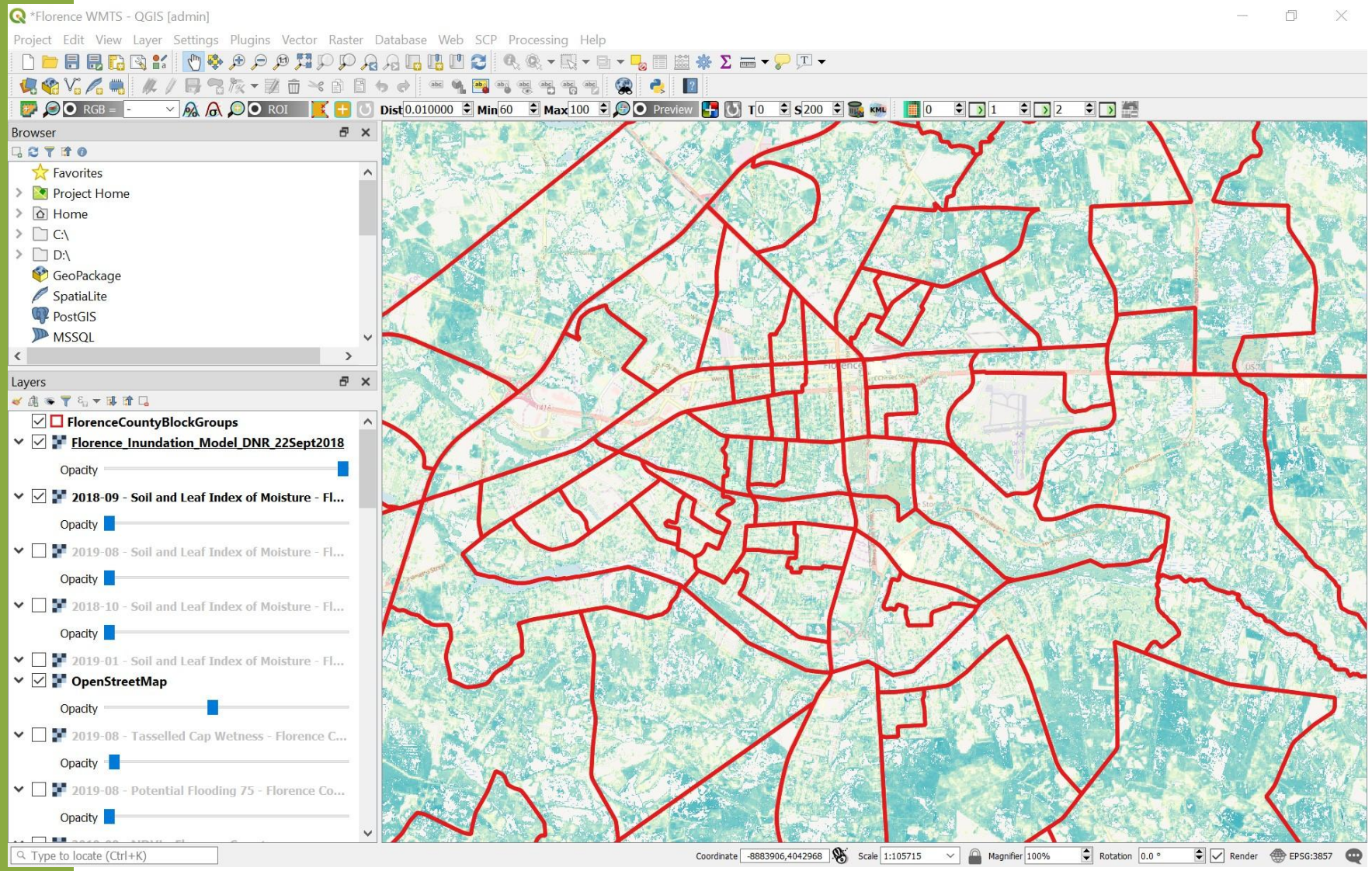
Florence Co

Visualization

Darker greater moisture

September 2018 Image Capture.



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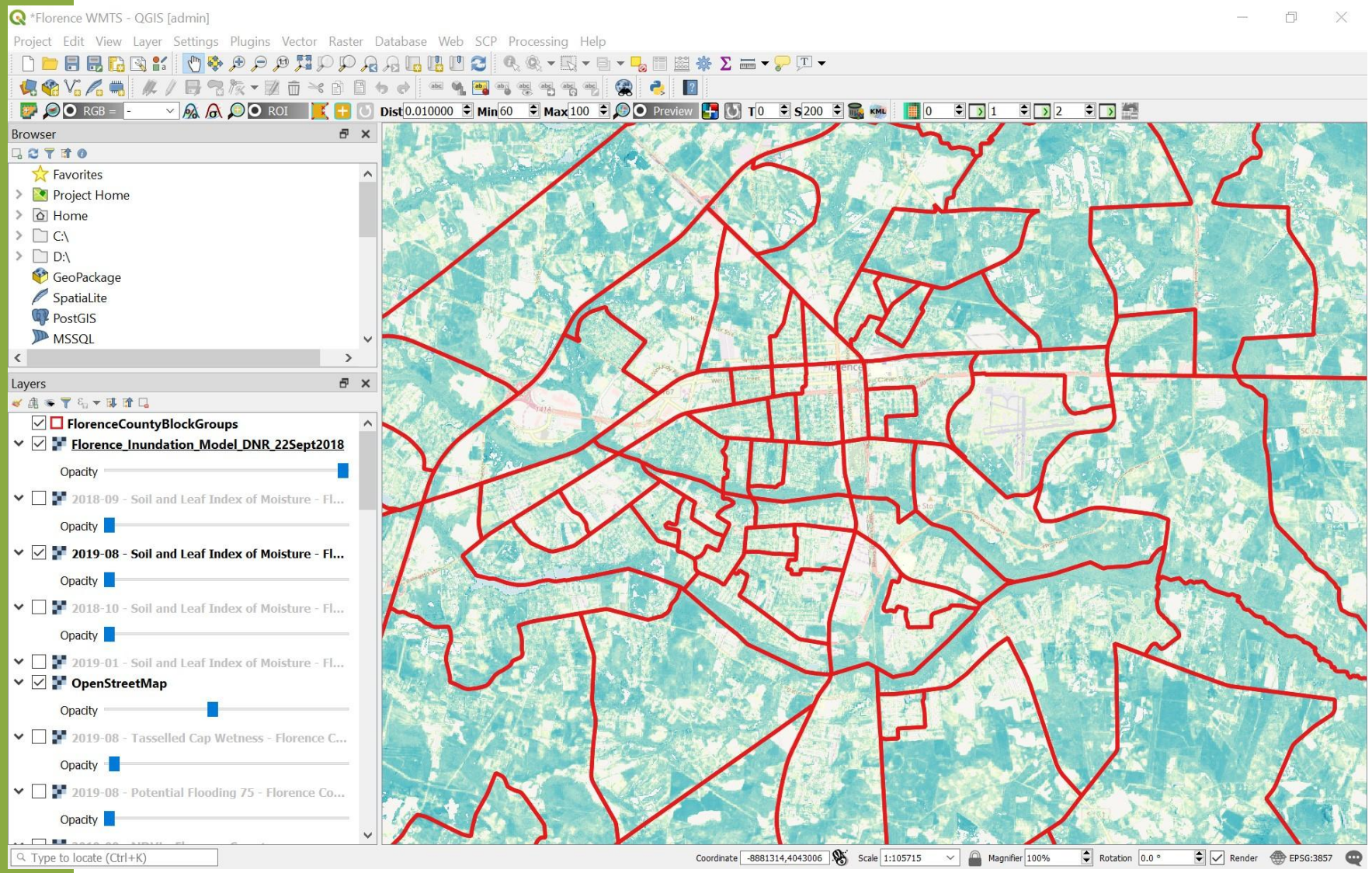
Visualization

Darker greater moisture

August 2019 Image Capture.



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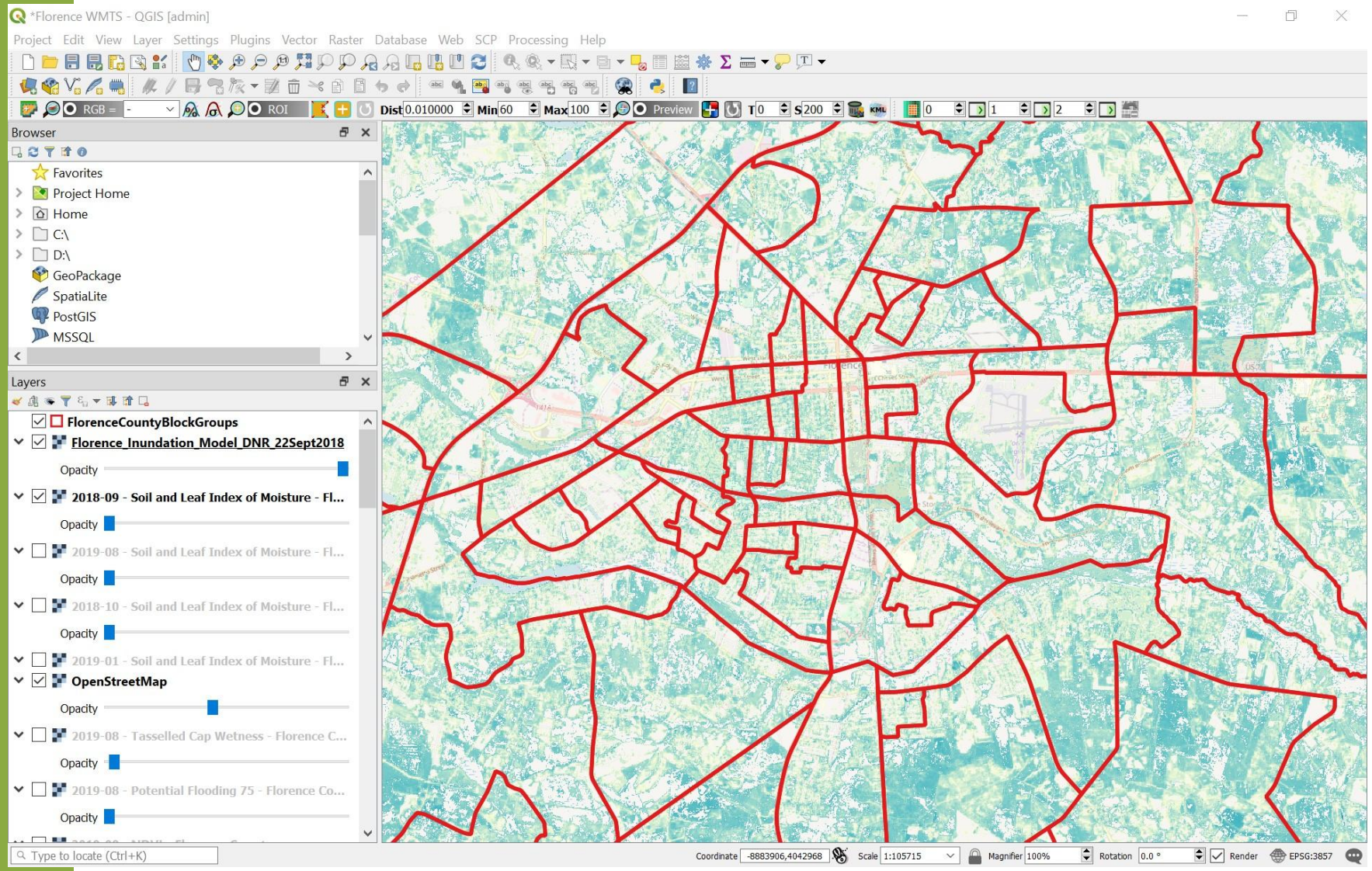
Visualization

Darker greater moisture

September 2018 Image Capture

SC Inundation Layer



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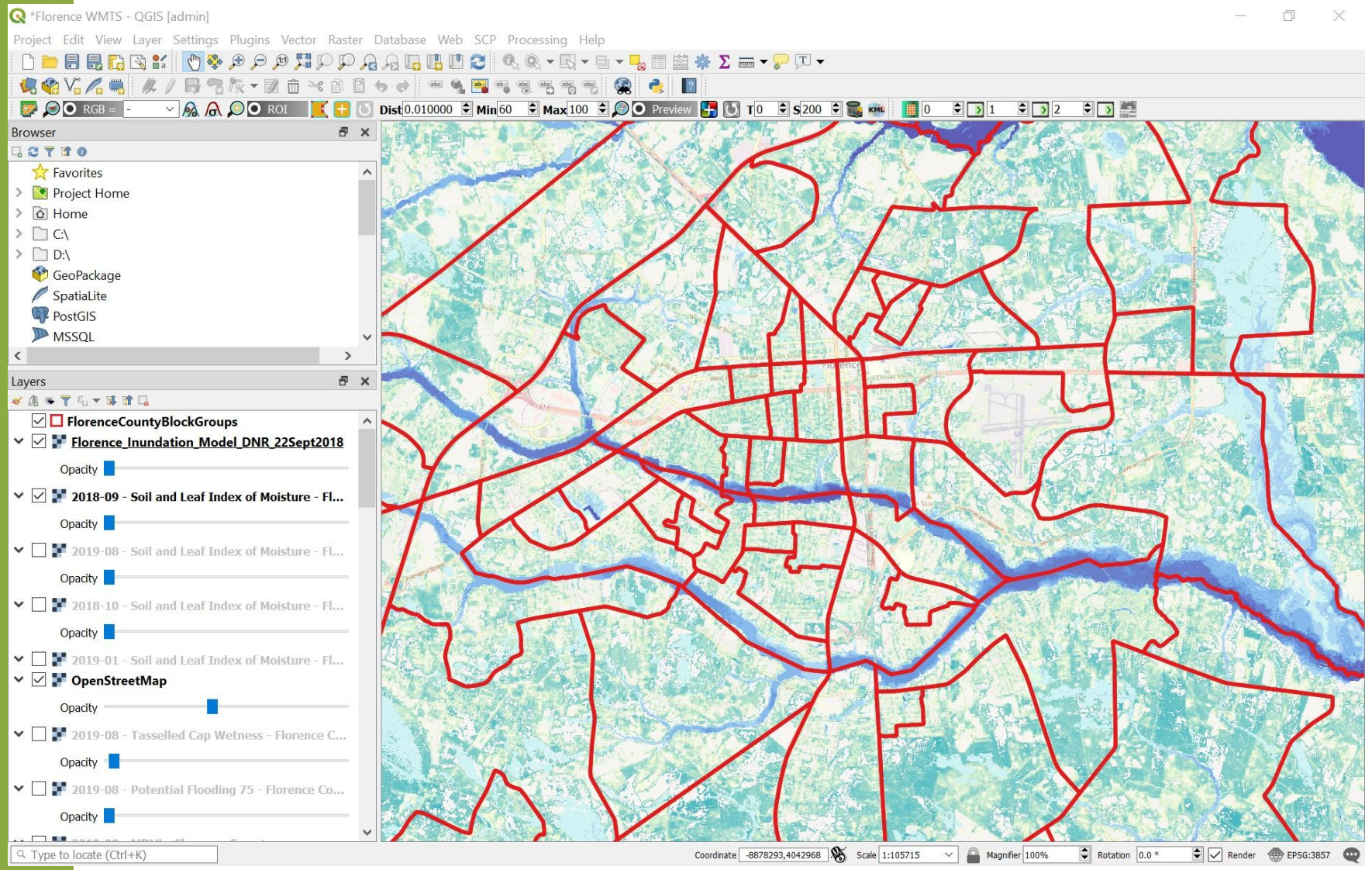
Visualization

Darker greater moisture

September 2018 Image Capture

SC Inundation Layer



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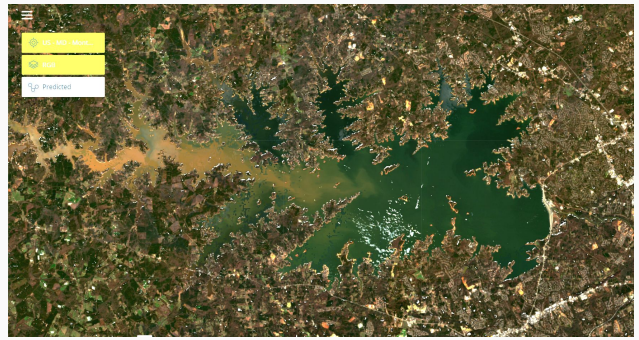
Summary

Data Ecosystem Community

- **ESI uses raw, recent imagery to deliver actionable data and analytics via a browser**
  - Always available
  - Real-time, ‘what if’ models
  - Green vs. gray infrastructure
  - Risk mitigation planning
  - Optimized taxation

Thank you,
Charles Mondello



Charlesm.ecosi@gmail.com
CEO ESI
ASPRS Fellow
Resident of Lake Murray, SC

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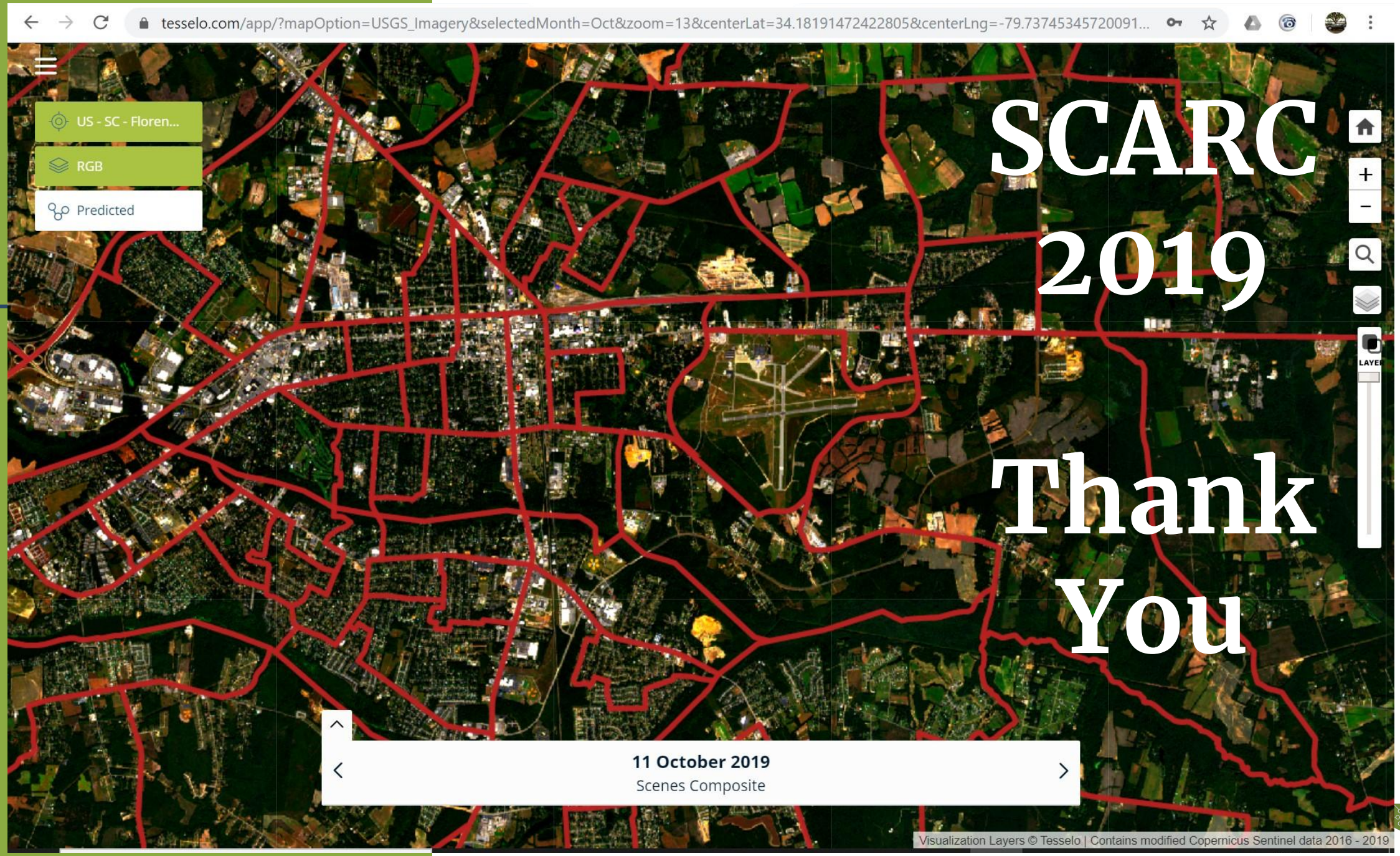

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