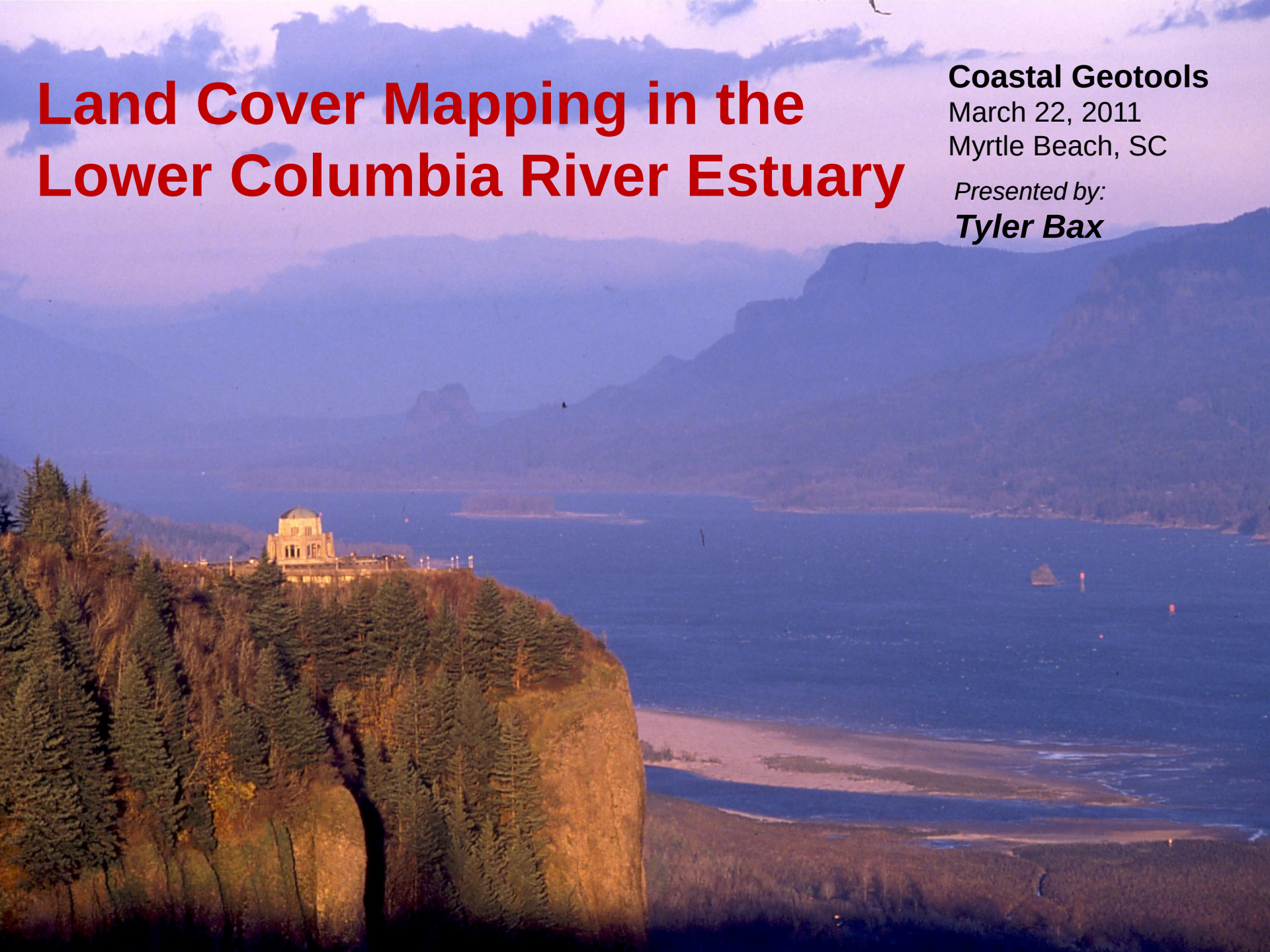
Land Cover Mapping in the Lower Columbia River Estuary

Coastal Geotools
March 22, 2011
Myrtle Beach, SC

Presented by:
Tyler Bax



Outline

1.

Lower Columbia River Estuary Partnership

NOAA — NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION — U.S. DEPARTMENT OF COMMERCE

SANBORN

2.

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Columbia River Estuary

- **The Lower Columbia River** estuary is a complex ecosystem that supports hundreds of species of animals and is home to hundreds of thousands of people.

- **Habitat Loss** over the past century due to diking and urban development, as well as hydrologic alteration due to operation of federal hydropower system.

- Currently 13 **ESA listed salmon** populations utilize the estuary

LCREP

USFS

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Introduction to LCREP

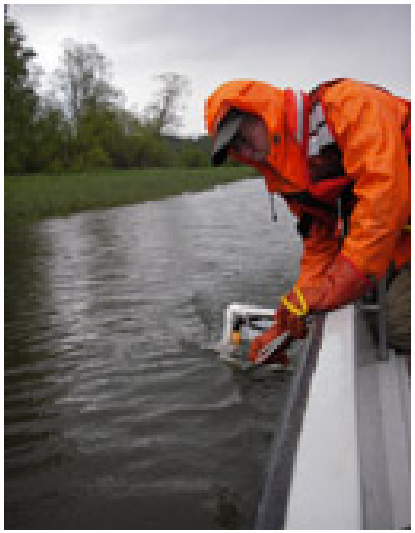
- **The Lower Columbia River Estuary Partnership (LCREP)** is one of 28 National Estuary Programs.

- Public-Private, 501c (3) Non – Profit Organization

- Work to protect the lower Columbia River Estuary through ecosystem monitoring, habitat restoration and educational programs.

- Focused on **tidally influenced** portion of the Columbia River

LCREP



LCREP

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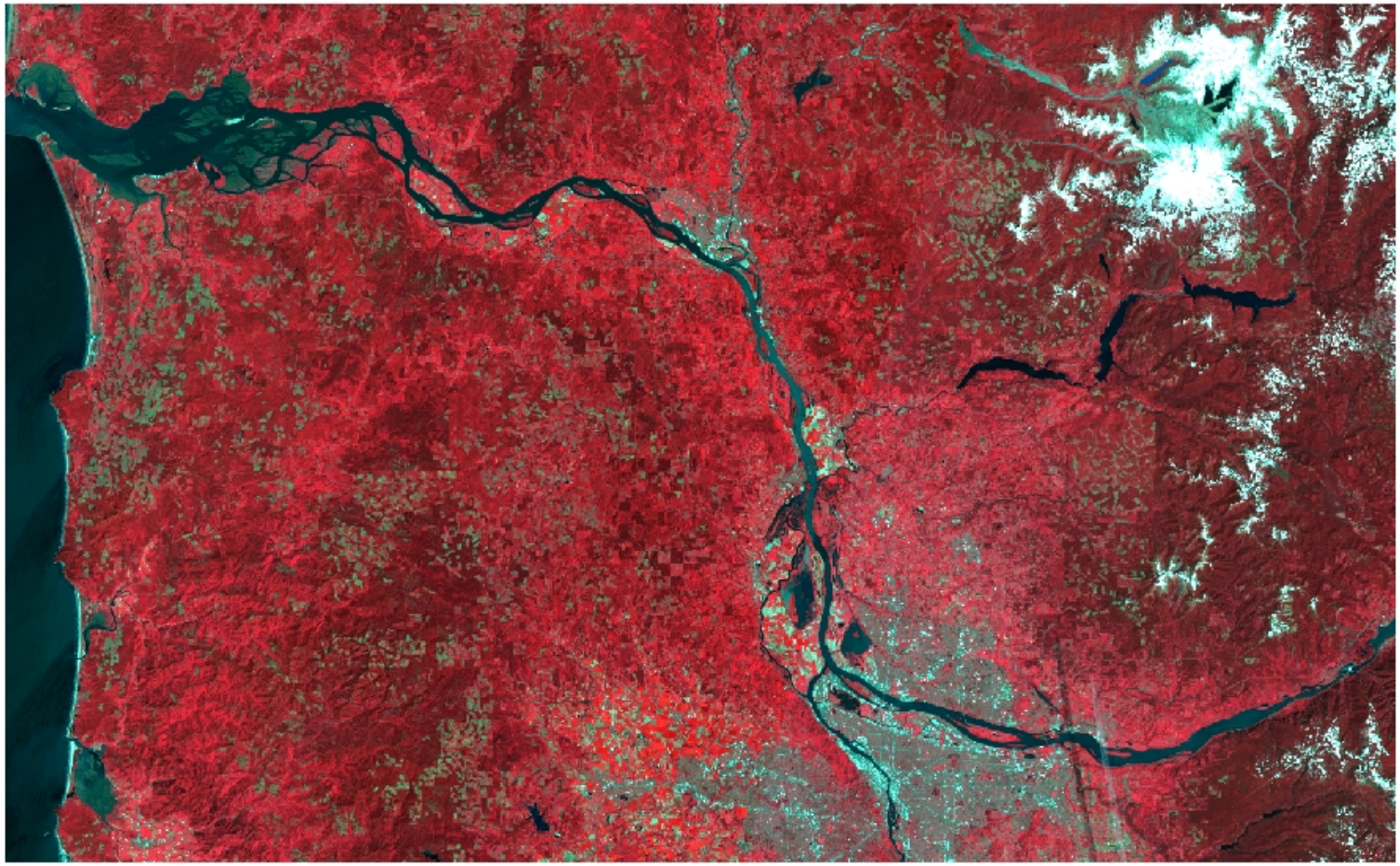
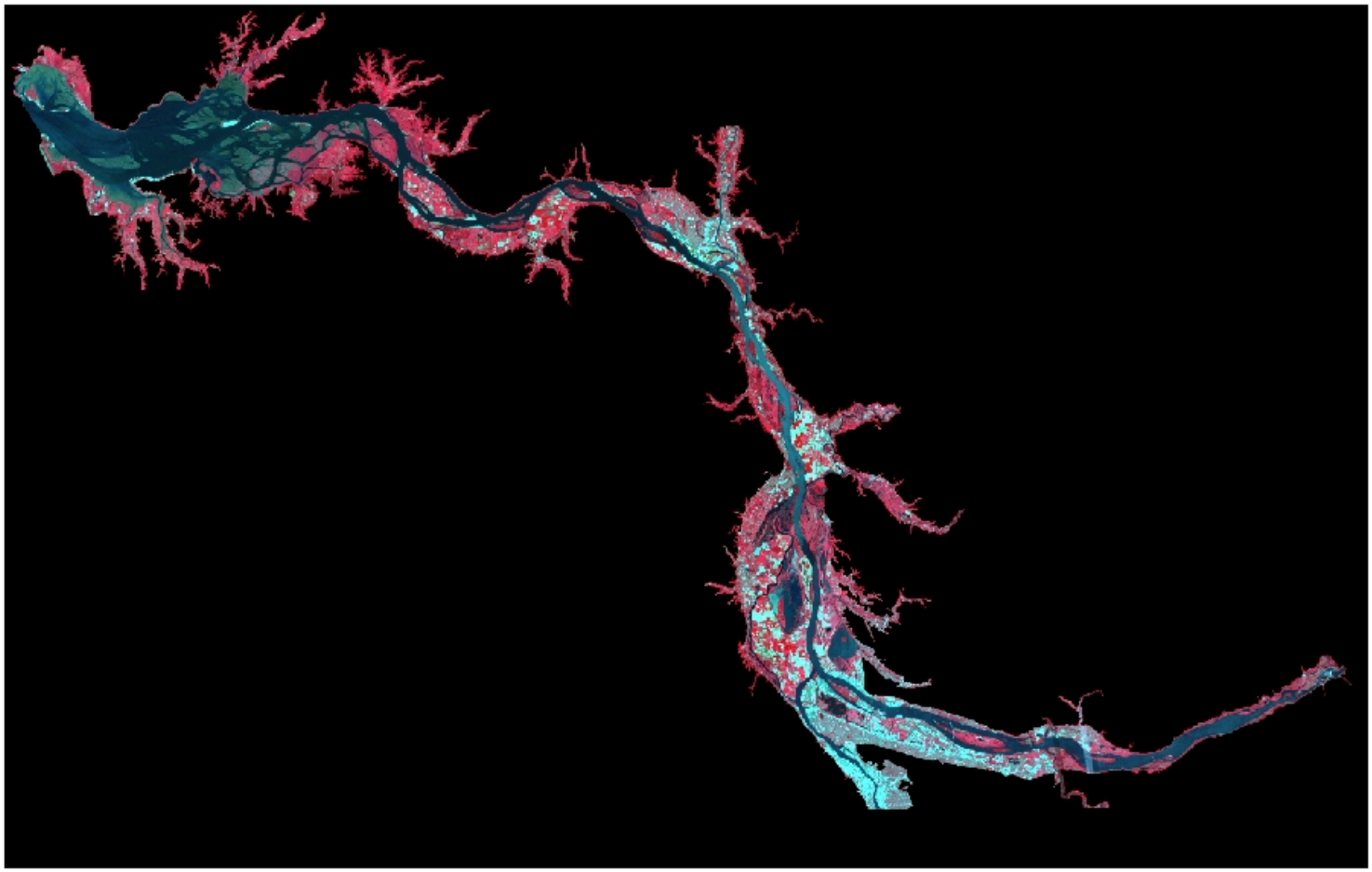
Where LCREP Works

- from **River Mile (RM) 0** at the river's mouth to **RM 145** below the **Bonneville Dam** and laterally from the **Columbia River** to **the historic floodplain** boundary.



Where LCREP Works

- The project areas extends longitudinally from **River Mile (RM) 0** at the river's mouth to **RM 145** below the **Bonneville Dam** and laterally from the **Columbia River** to **the historic floodplain** boundary.



Ecosystem Classification

Lower Columbia River Estuary Partnership

6 Hierarchical levels to be used for sampling design and restoration prioritization

Level	Name	Definition	Status
1	**Ecosystem Province**	EPA Level II Ecoregions	Complete
2	**Ecoregion**	EPA Level III Ecoregions	Complete
3	**Hydro-geomorphic Reach**	EPA Level III and IV Ecoregions modified to reflect transitions in strong, large-scale hydrogeomorphic and tidal fluvial forcing,.	Complete
4	**Ecosystem Complex**	Units representing distinct channel and floodplain features, e.g., floodplain island, tributary channel	Anticipated completion 2011
5	**Geomorphic Catena**	Ecosystem structures reflecting geomorphic processes (various maturity stages of emergent marsh, high vs. low order dendritic channels)	Anticipated completion 2011
6	**Primary Cover Class**	Vegetation cover (i.e. forested, herbaceous, scrub-shrub) with wetland/upland and diked/tidal/upland modifiers.	Expected 2011

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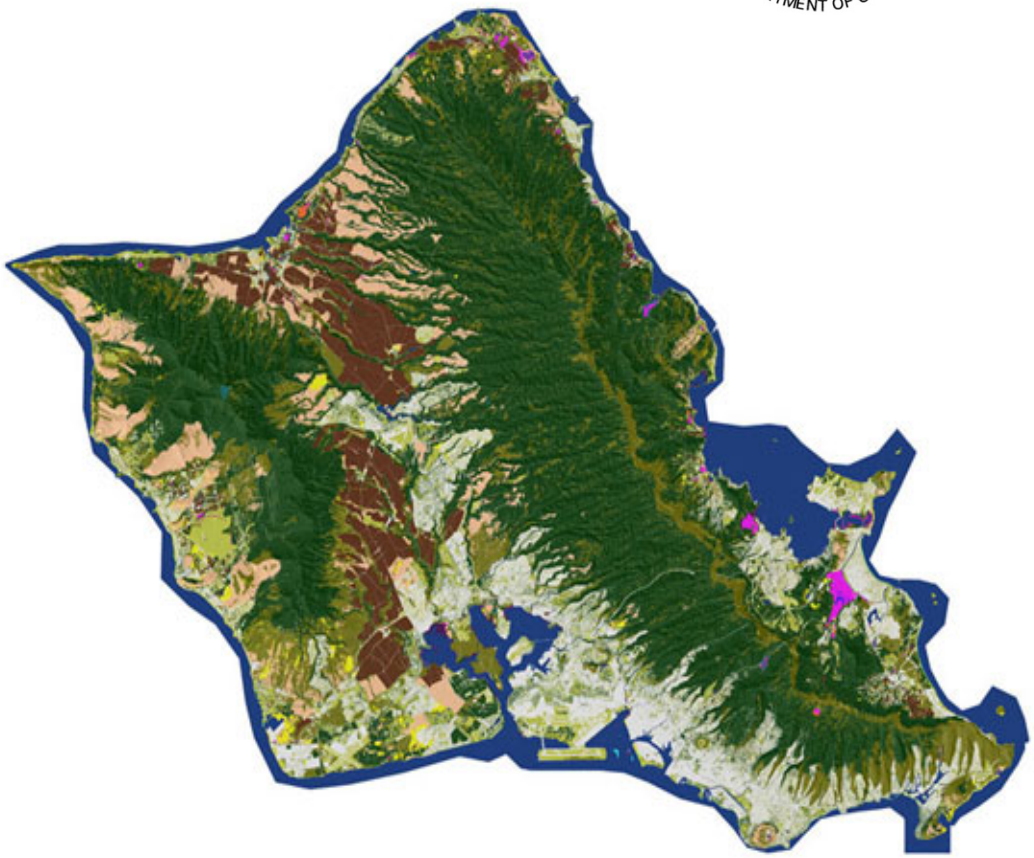
NOAA Coastal Services Center

- Contact between **NOAA** *CSC* and **LCREP**

- **NOAA** brings experience and guidance to the project. Help choosing a mapping framework , classification scheme development, field sampling, and quality control**.**

- Able to leverage LCREPs mapping efforts to enhance their C-CAP products.

- **The Sanborn Map Company** was chosen to map the vegetation of the project area



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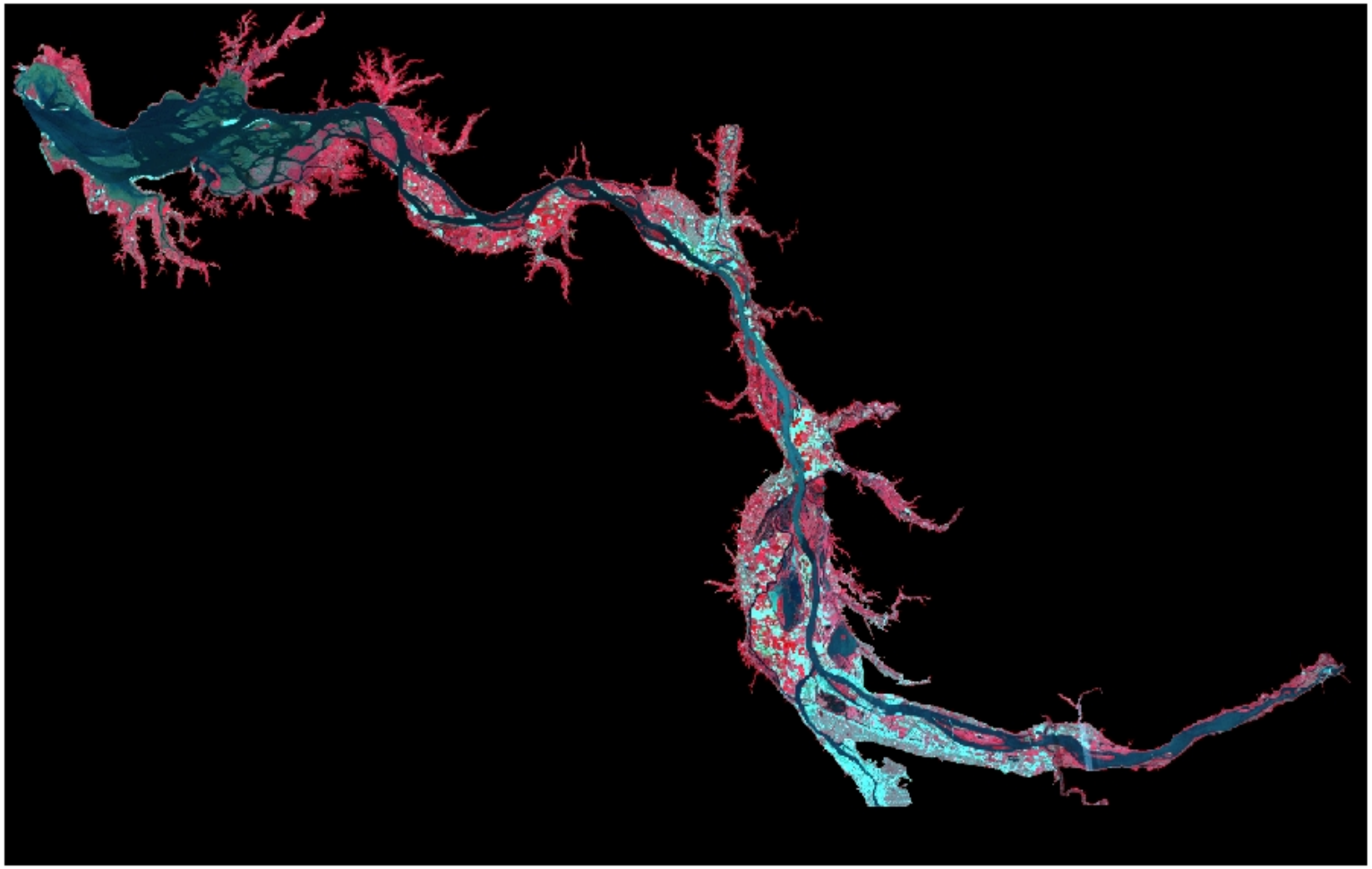
Project area



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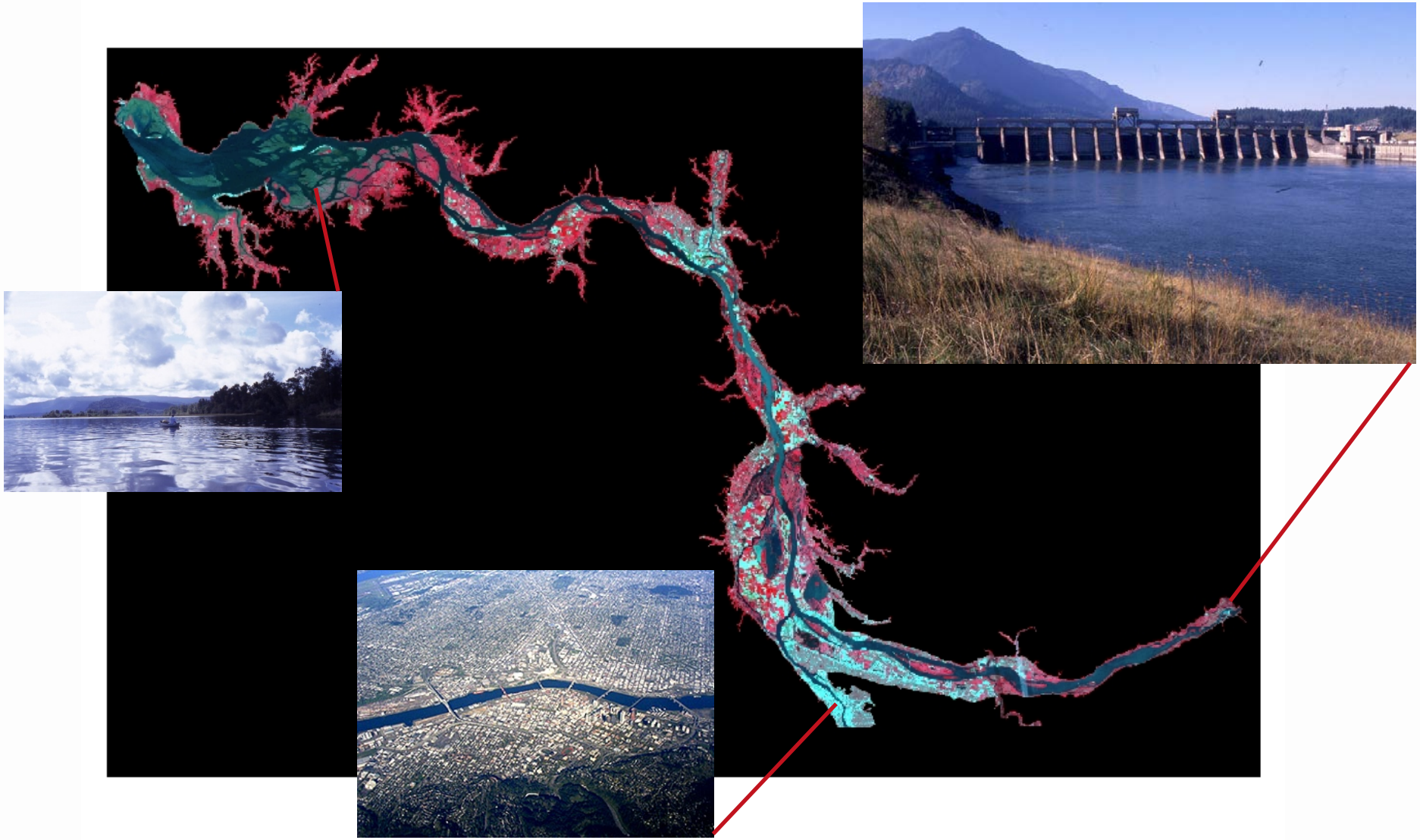

NASA

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Work Flow Overview

- Image Selection and Pre-processing
- Develop Classification Scheme
- Develop Image Segments

- Field Sampling
- Select Accuracy Assessment Points
- CART Analysis to label segments
- Preliminary Map Editing

- Field Review and additional Training Points
- Draft Map modeling and review
- Draft Map accuracy assessment
- Final Map production and accuracy assessment

- Final Delivery

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Ingredients Needed

- **Data** used:
  - **Landsat imagery**

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Ingredients Needed

- Data used:
  - Landsat imagery
  - **airborne ADS40 imagery (NAIP)**

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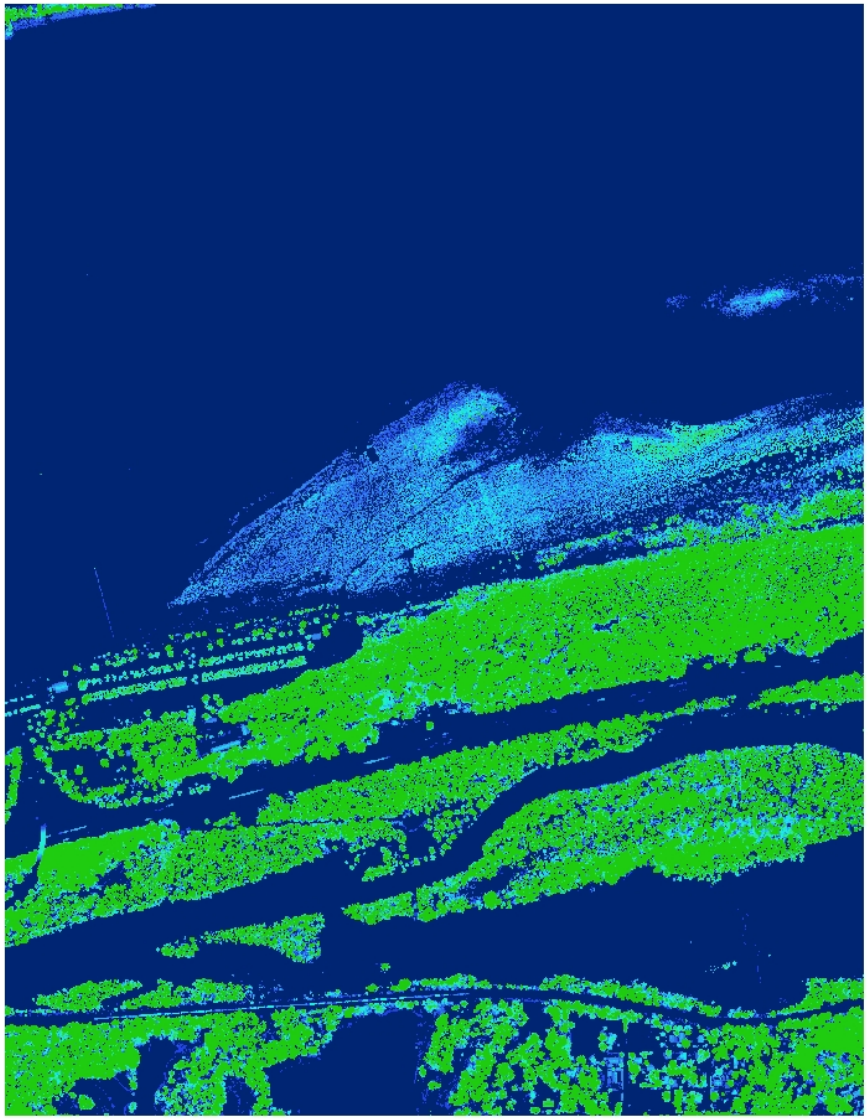
Ingredients Needed

- Data used:
  - airborne ADS40 imagery
  - Landsat imagery
  - **LiDAR**



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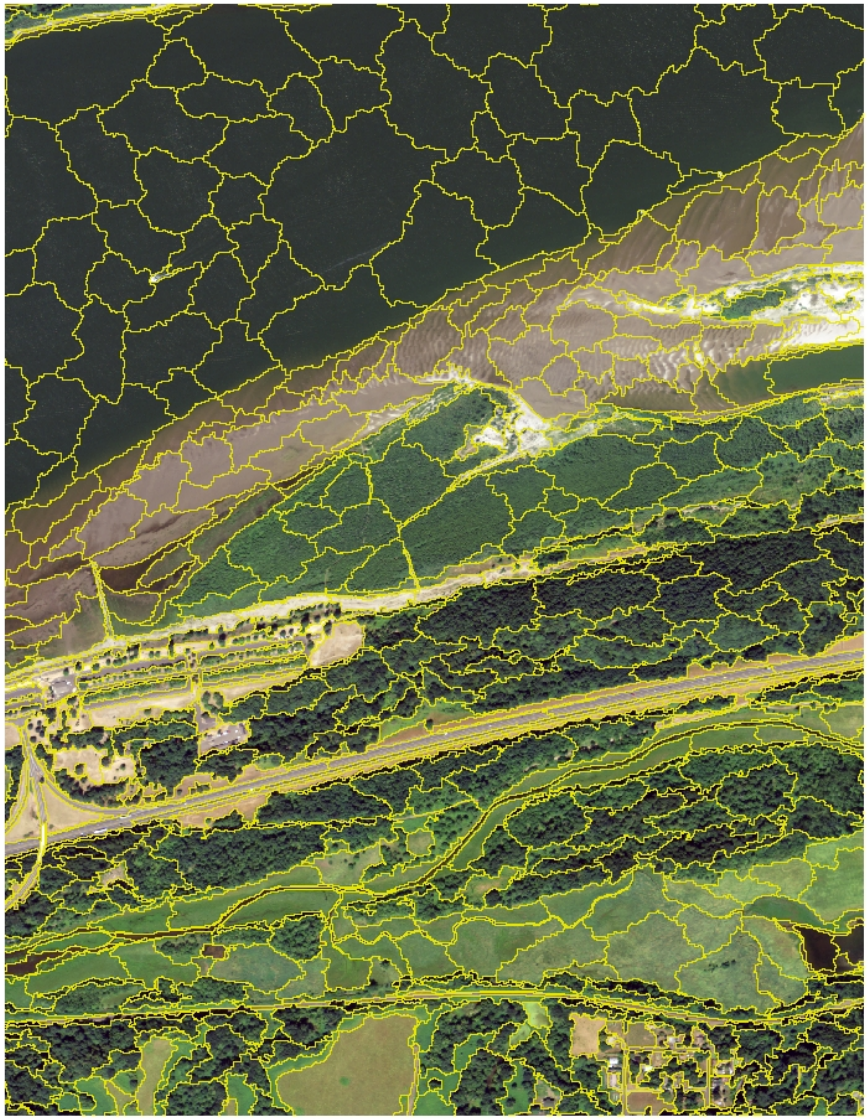
Ingredients Needed

- Data used:
  - airborne ADS40 imagery
  - Landsat imagery
  - LiDAR
  - **image segmentation**



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Ingredients Needed

- Data used:
  - airborne ADS40 imagery
  - Landsat imagery
  - LiDAR
  - image segmentation
  - **ancillary data**

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Ingredients Needed

- In the fall of 2009 **LCREP** chose
- **The Sanborn Map Company** to use:
  - airborne ADS40 imagery
  - Landsat imagery
  - LiDAR
  - image segmentation
  - ancillary data
  - **field visits**
  - **and photo interpretation**

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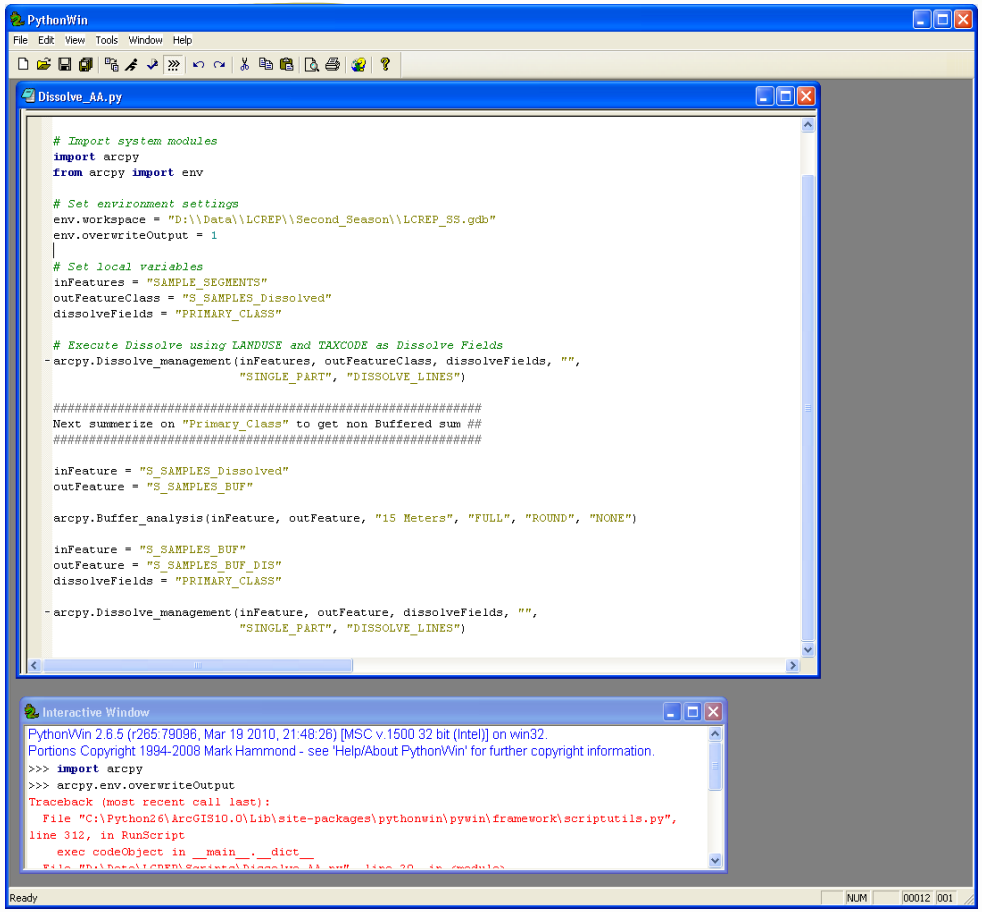
Ingredients Needed

- Data used:
  - airborne ADS40 imagery
  - Landsat imagery
  - LiDAR
  - image segmentation
  - ancillary data
  - field visits
  - photo interpretation
  - **GIS biophysical modeling**



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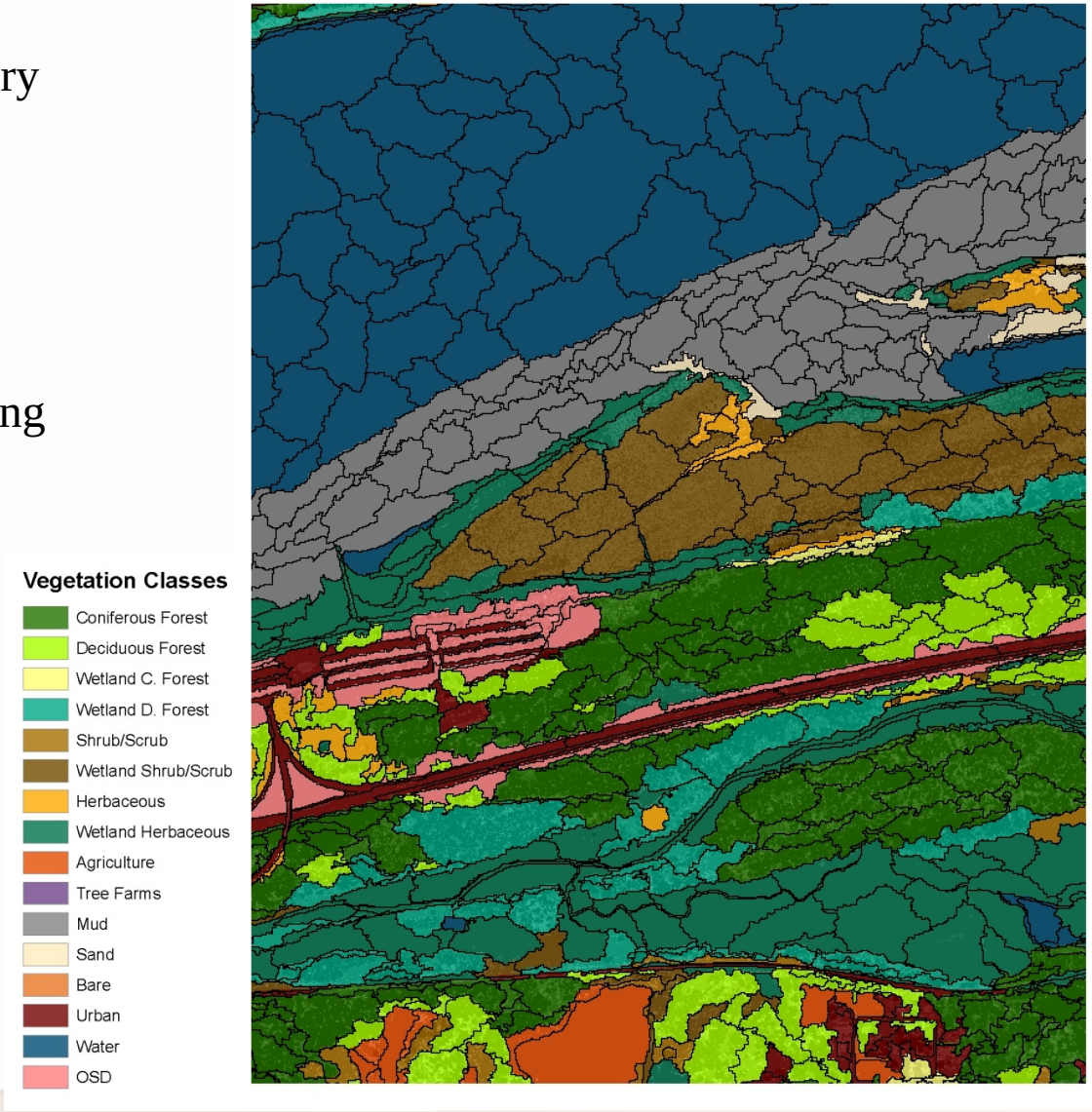
Ingredients Needed

- Data used:
  - airborne ADS40 imagery
  - Landsat imagery
  - LiDAR
  - image segmentation
  - ancillary data
  - GIS biophysical modeling
  - photo interpretation
  - and field visits

to map the vegetation of the project area.



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Classification Scheme

- *Upland Forest*
  - **Coniferous Upland Forest**
  - **Deciduous Upland Forest**
  - **Mixed Upland Forest**
- *Wetland Forest*
  - **Coniferous Wetland Forest**
  - **Deciduous Wetland Forest**
  - **Mixed Wetland Forest**
- **Upland Shrub/Scrub**
- **Wetland Shrub/Scrub**
- **Upland Herbaceous**
- **Wetland Herbaceous**
- **Aquatic Beds**
- **Agriculture**
  - **Tree Farms**
- **Mud**
- **Sand**
- **Bare**
  - **Rock**
  - **Cobble**
- **Urban – Impervious**
- **Open Space Developed**
- **Water**

Level I	Level II	Level III	Level IV	GIS Modifier
Vegetated	Forest	Upland	Coniferous	
			Deciduous	
			Mixed	
		Wetland	Coniferous	Tidal/ Diked
			Deciduous	Tidal / Diked
			Mixed	Tidal / Diked

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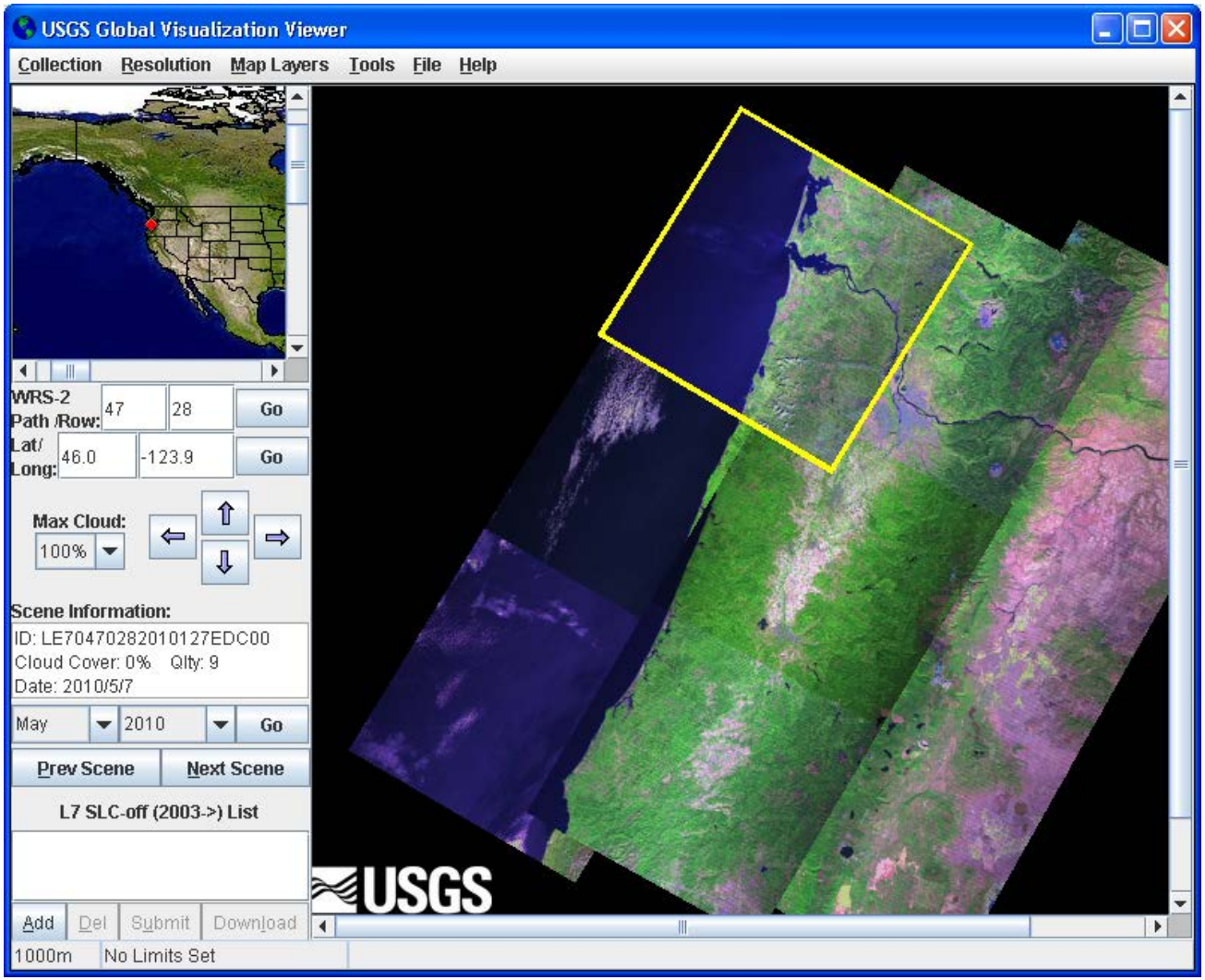
Imagery Selection

- ADS40
  - NAIP 2009
  - 1 meter
  - 4 Band
  - 8 Bit
- **Landsat 5**
  - Looking for post 2006



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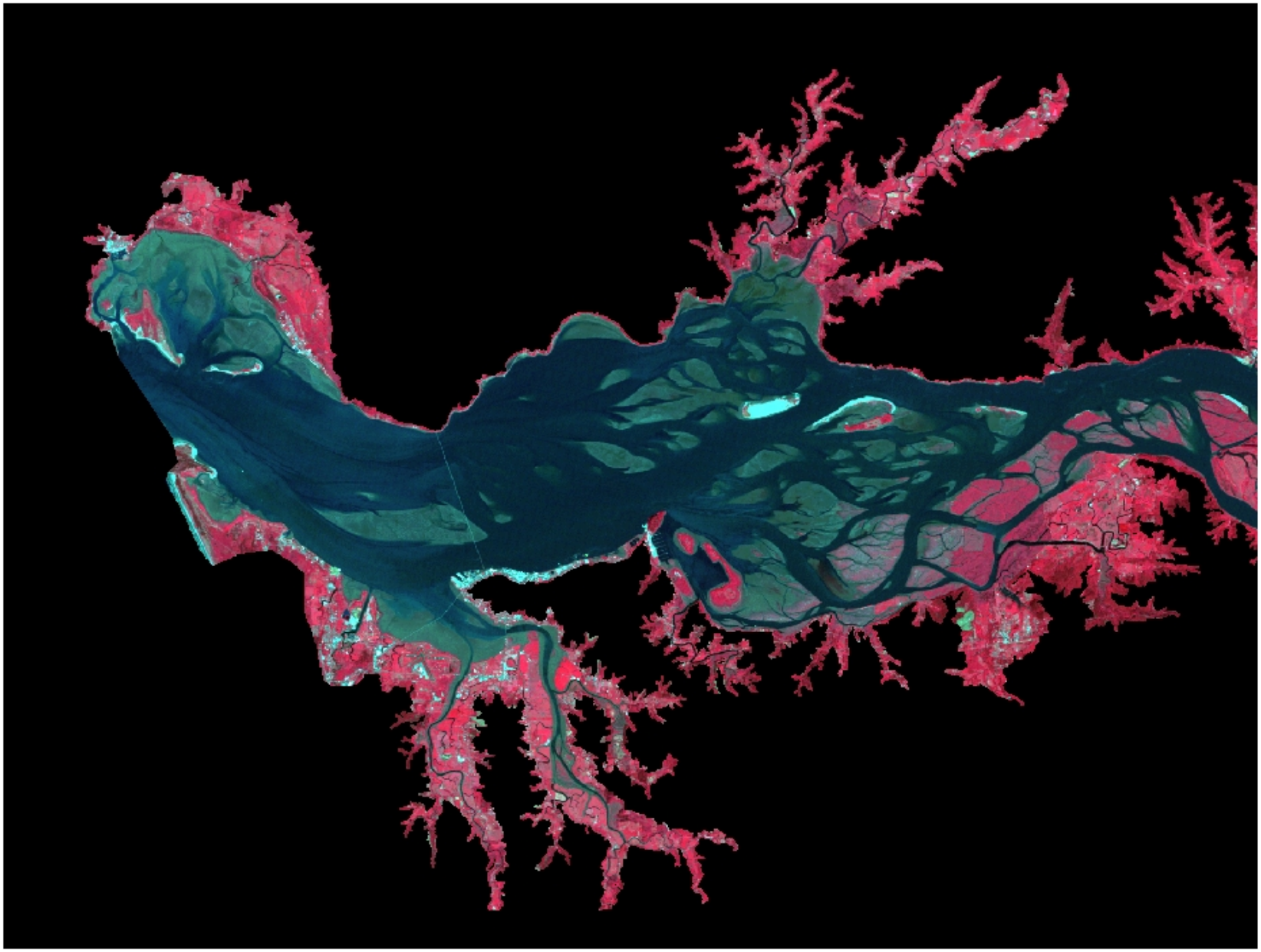
River Water Level



River Water Level - Landsat

Year	Date	Scene (W=47, E=46)	Sensor	Astoria Tide Level (ft, mlw)	Longivew Tide Level (ft, mlw)	Max Cloud Cover (%)
2009	21-May	46	TM5		4	3
2009	28-May	47	TM5	-1		3
2007	1-Jun	46	TM5		1.7	OK over AOI
2007	7-May	47	TM5	-0.8		OK over AOI
2006	16-Jul	46	TM5		1.8	3
2009	29-Jun	47	TM5	1		9
2008	7-Sep	46	TM5		0.5	3
2006	25-Sep	47	TM5	4		3

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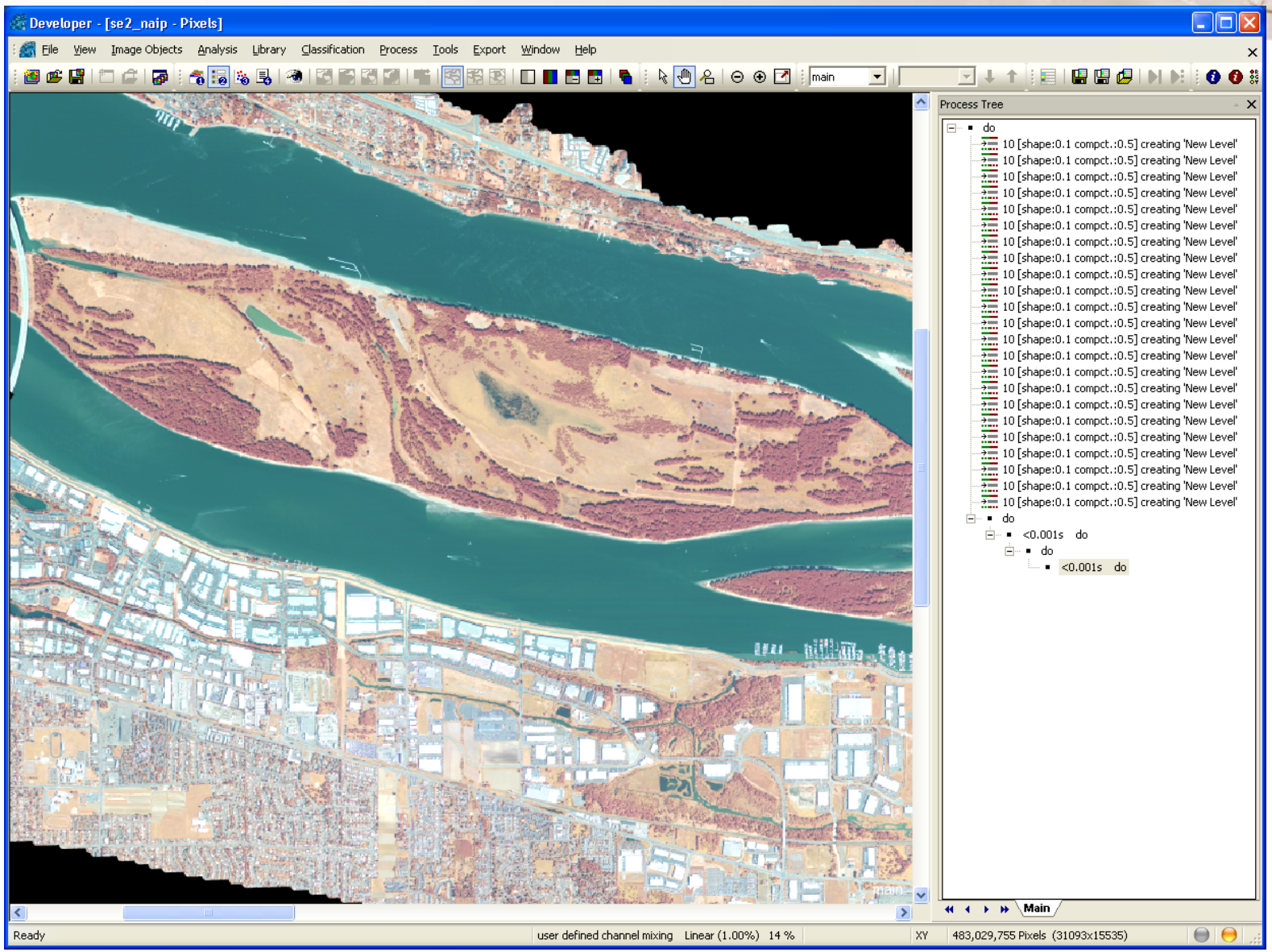
Segmentation



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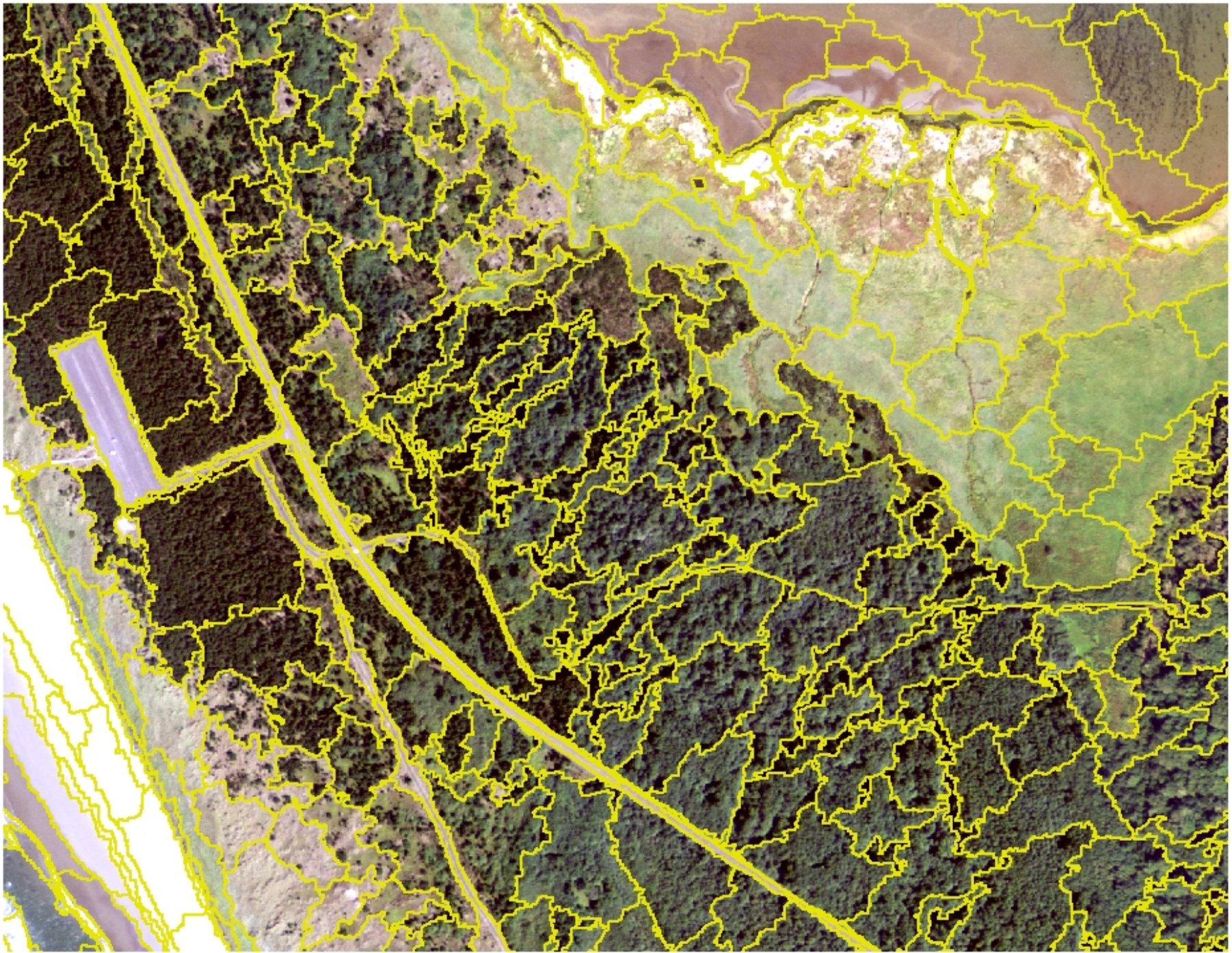
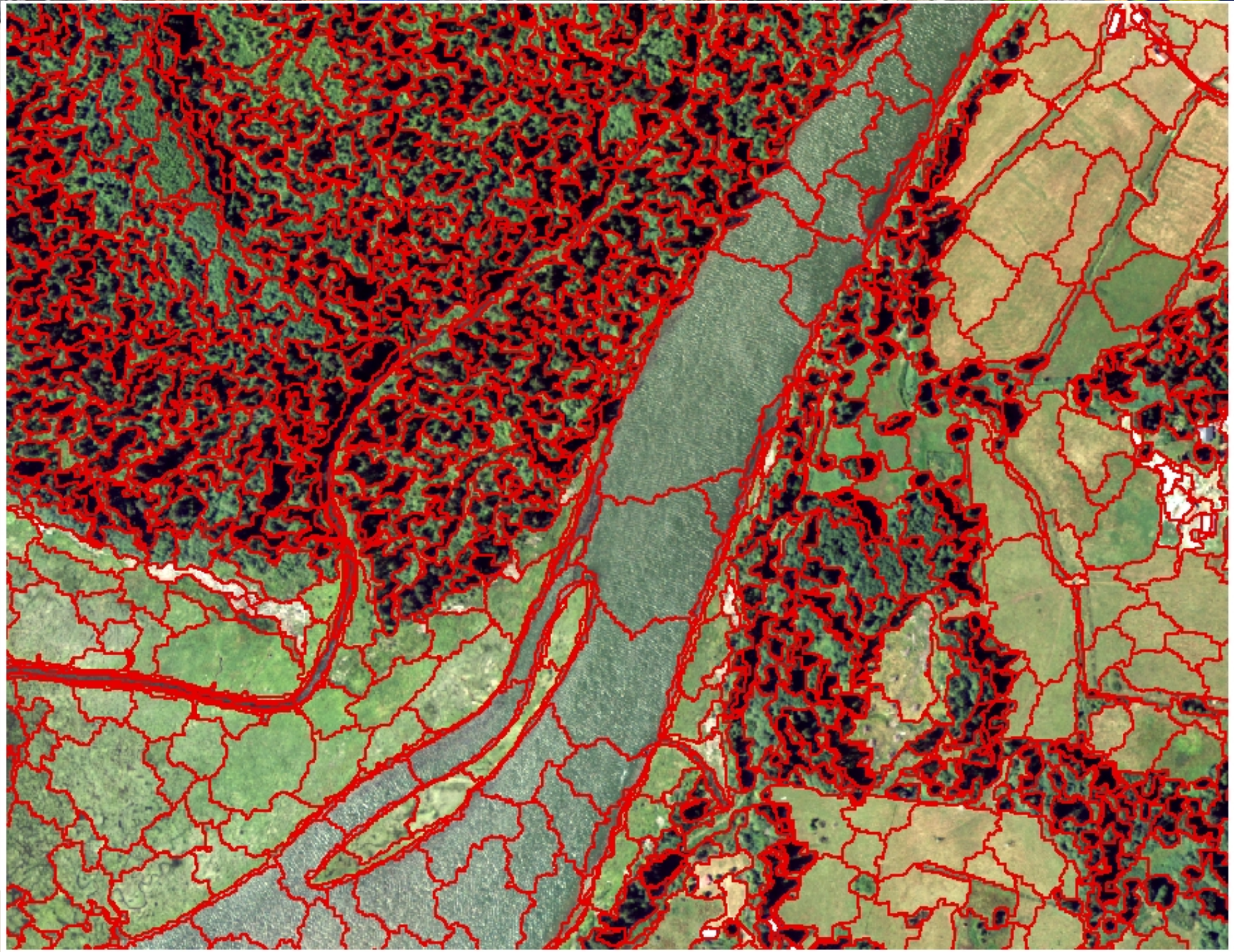
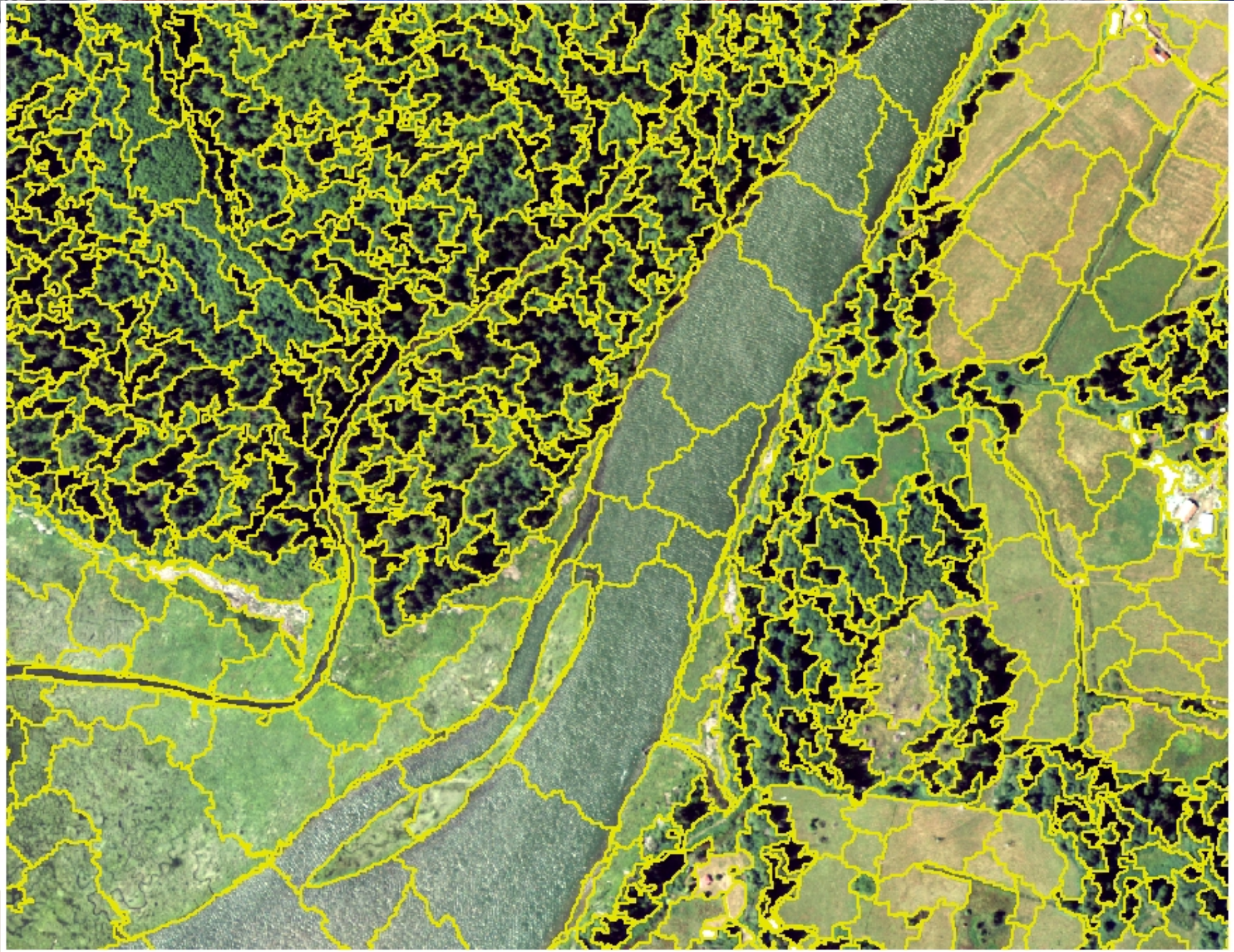
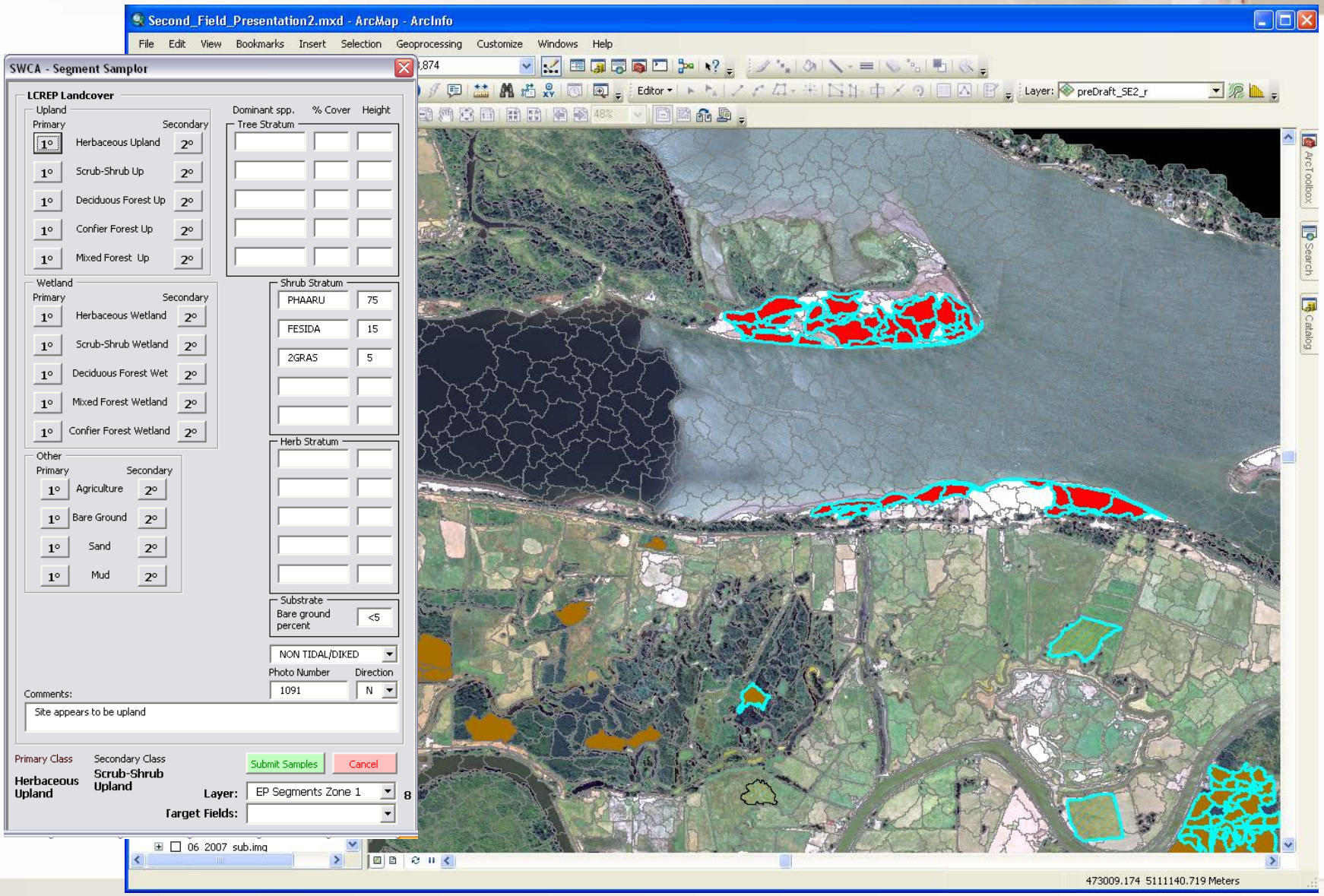






Field Sampling

Field Sampling



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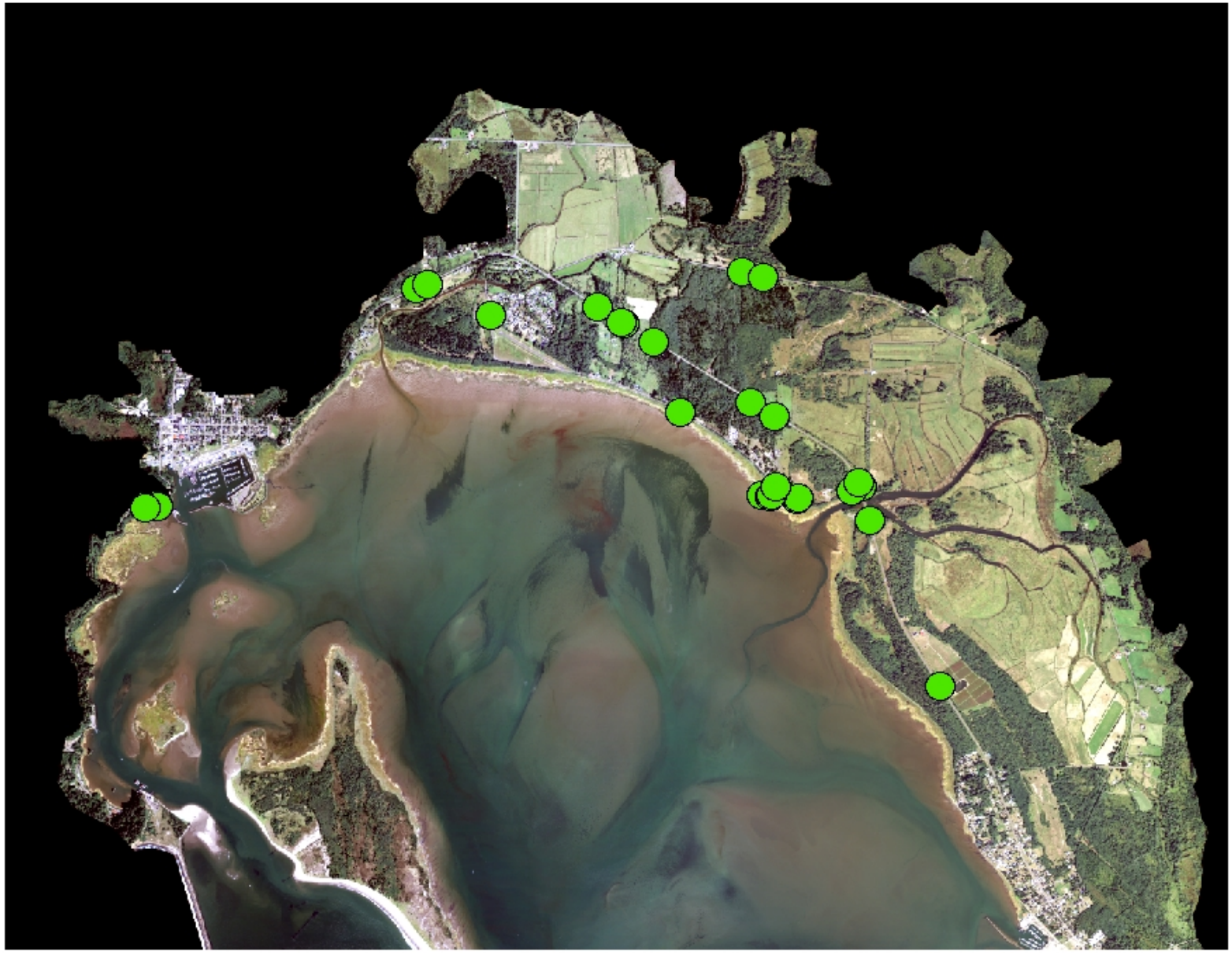
Photos



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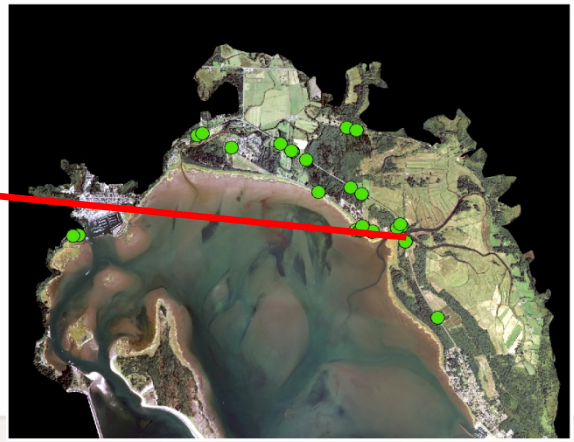

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Selecting AA Points

- Dissolving then buffering, then dissolving again –

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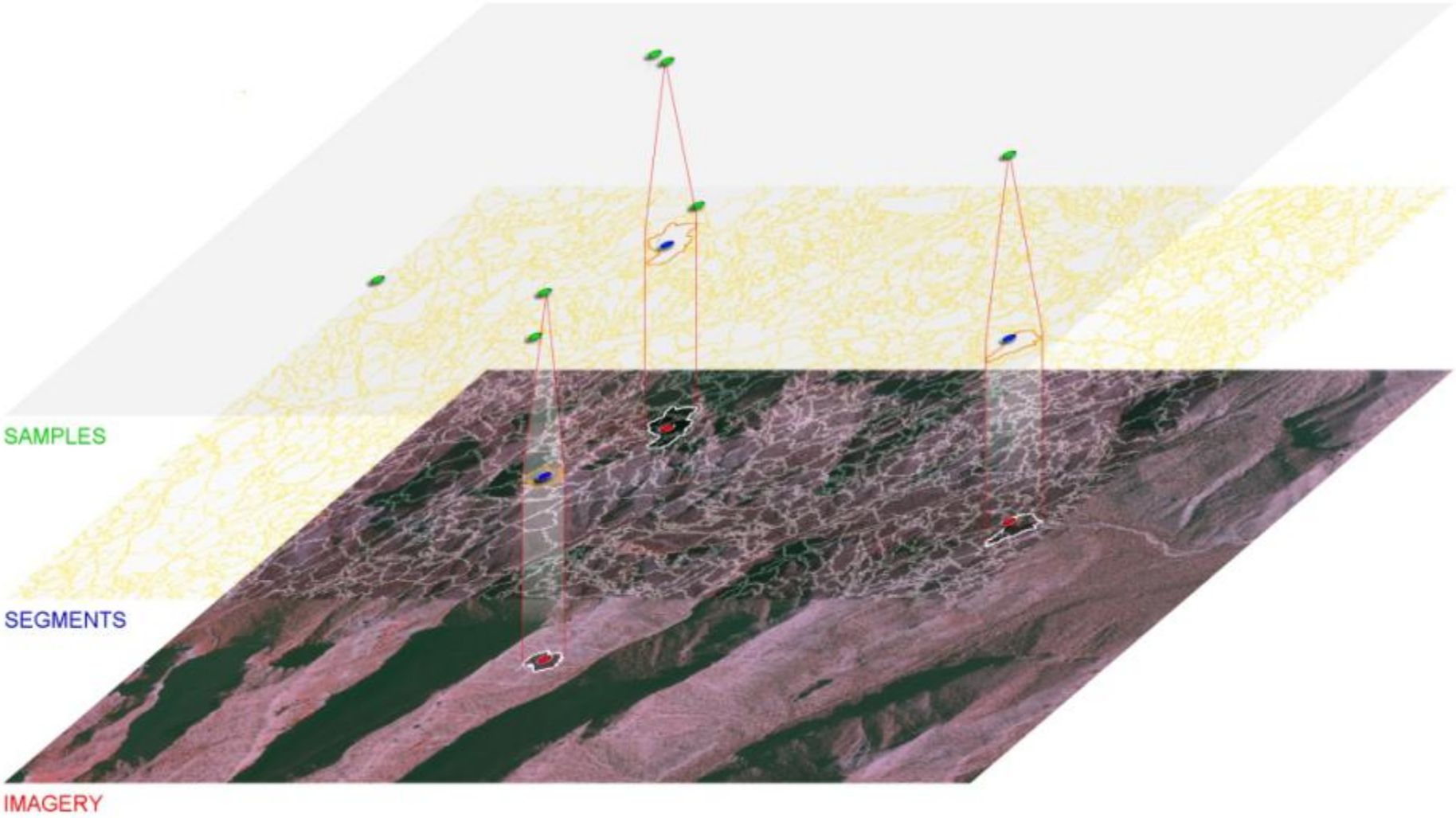
Sampling and CART



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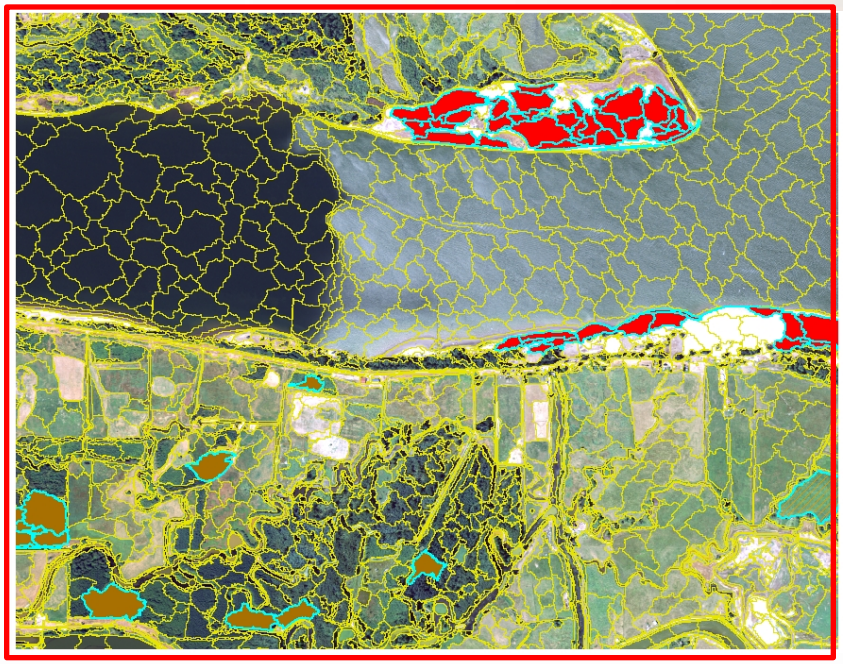
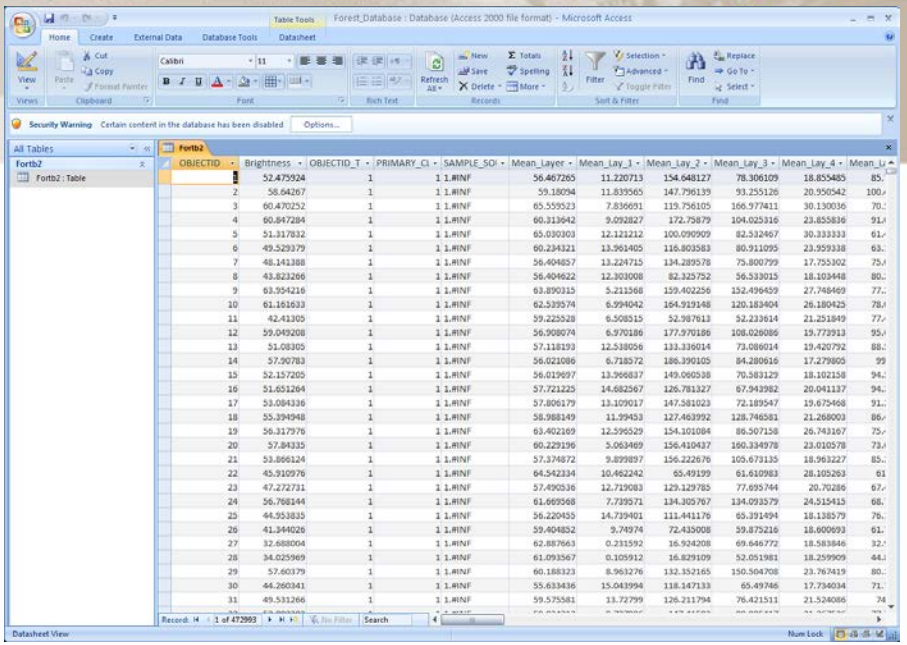
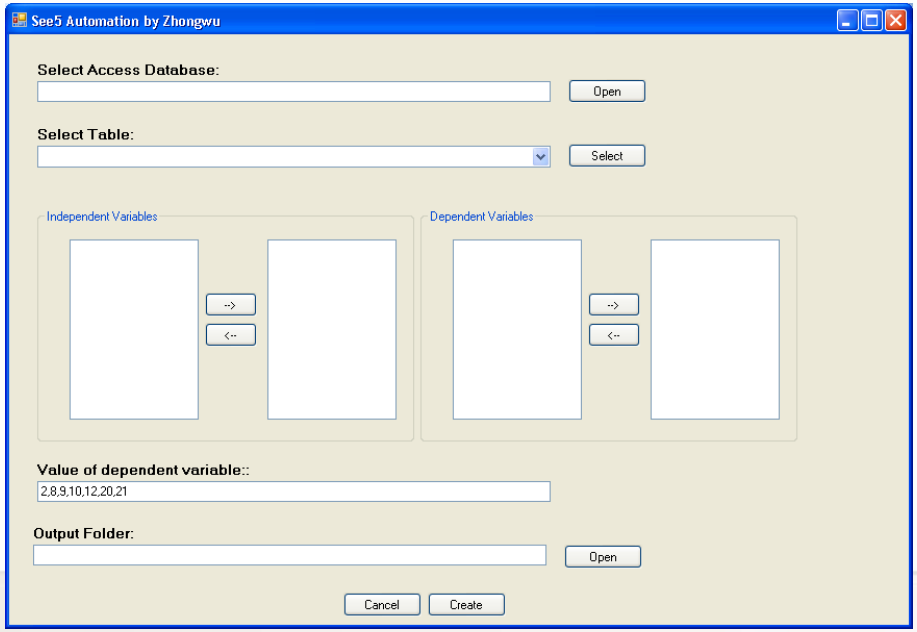
CART Modeling







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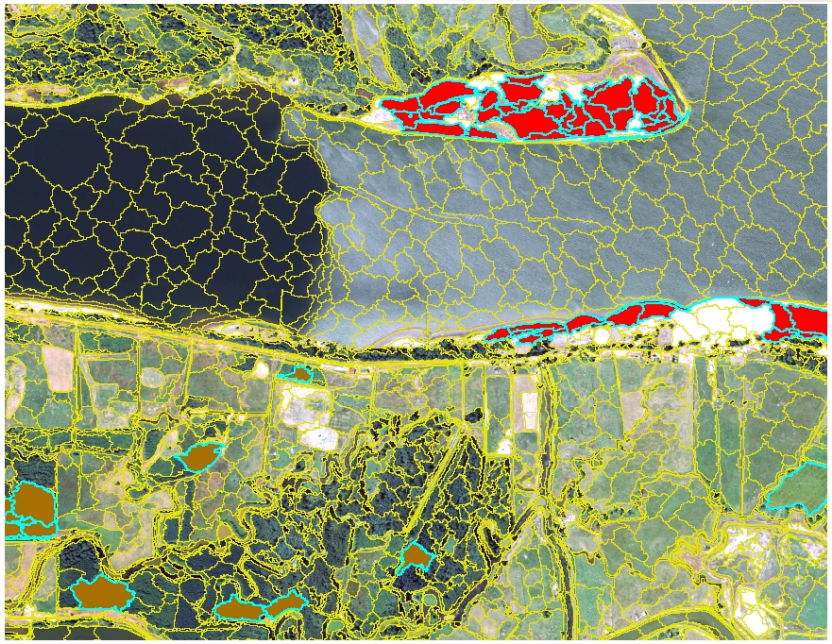

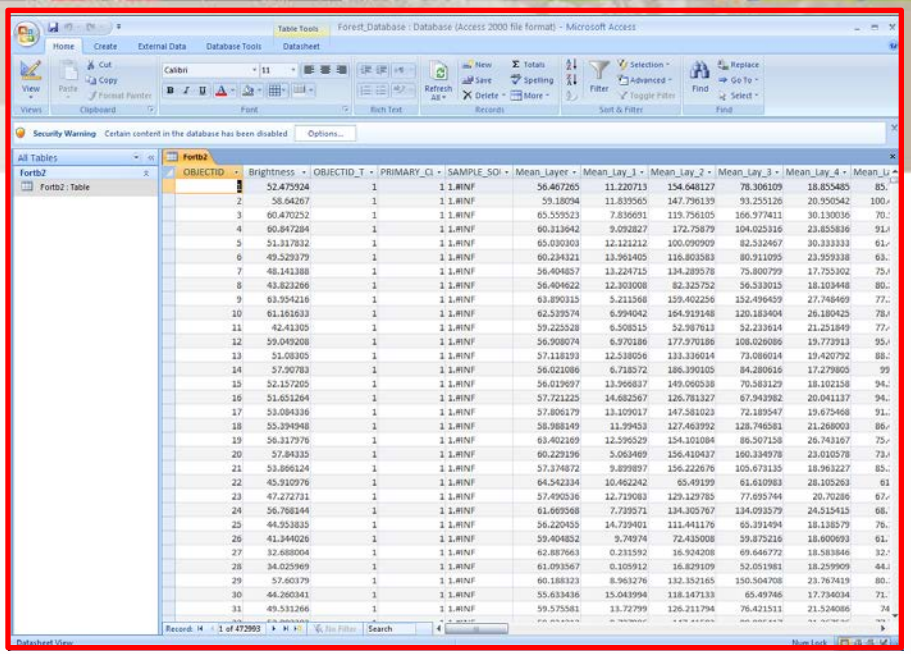

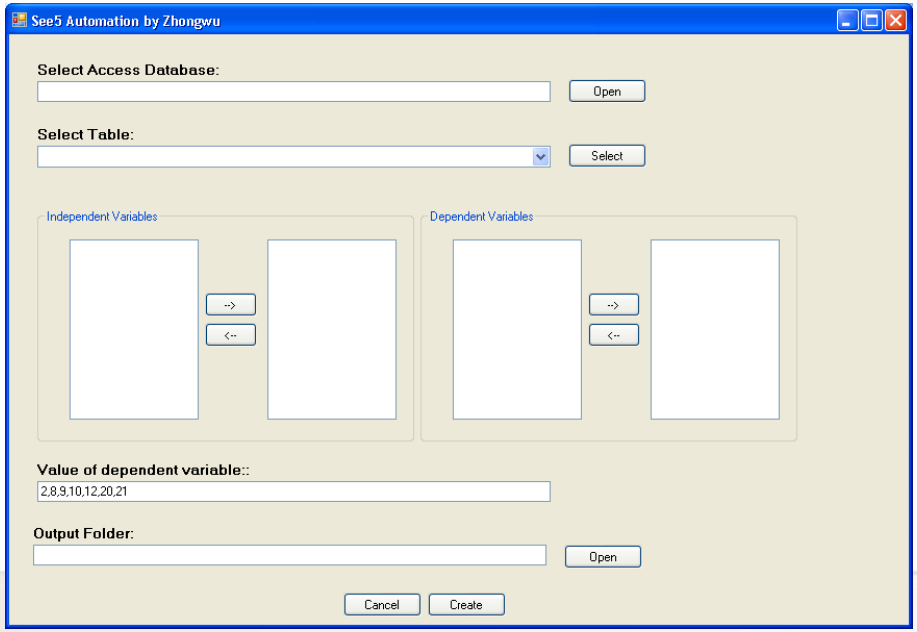

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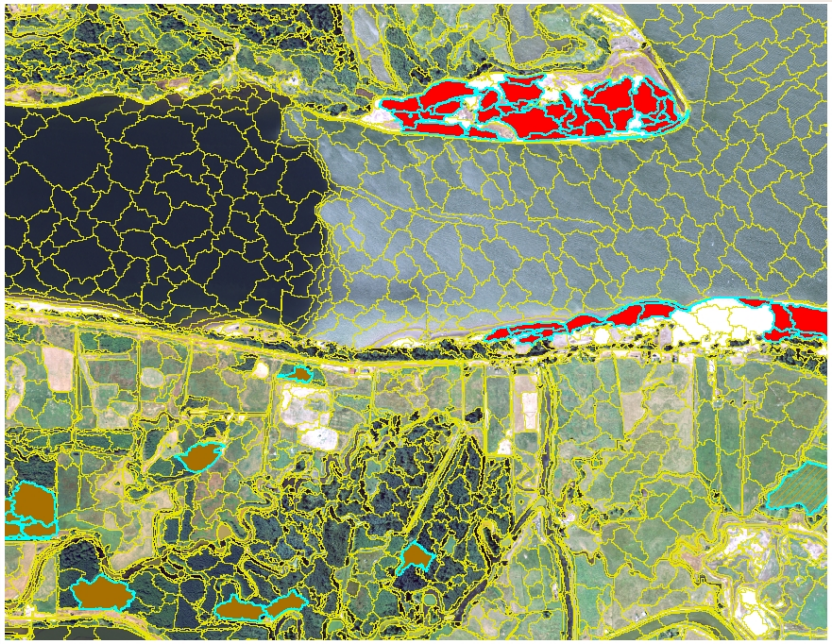

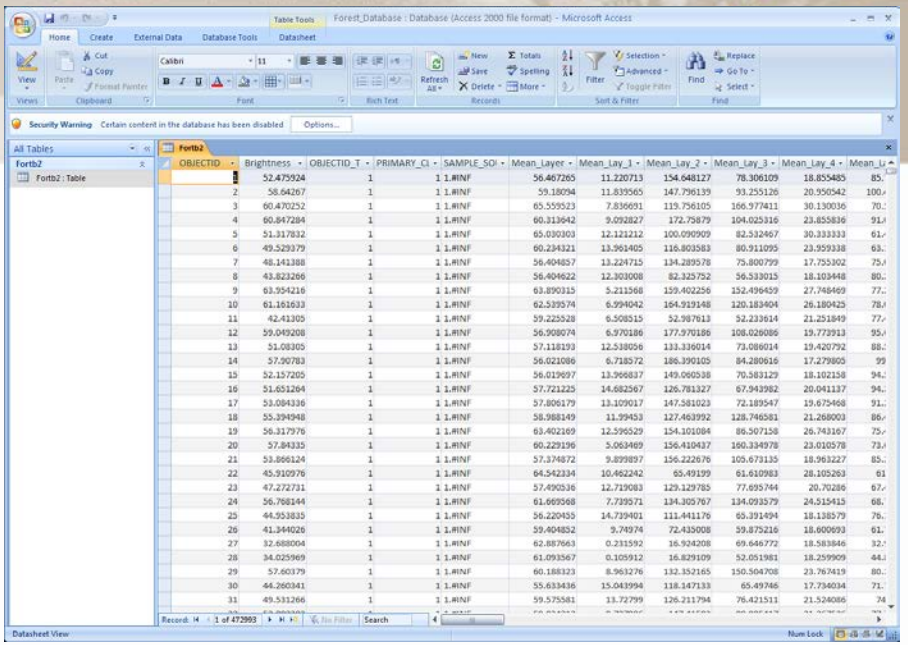

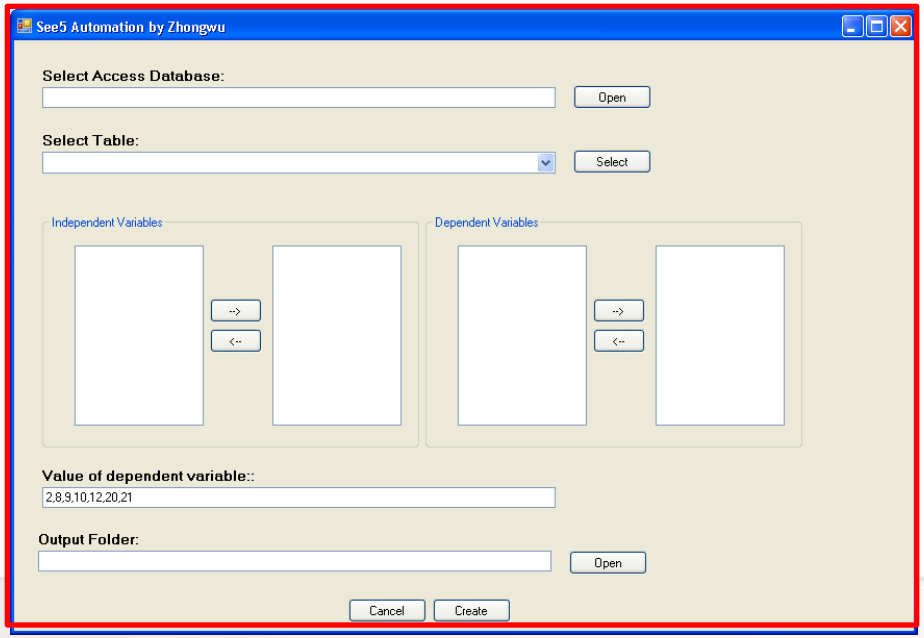

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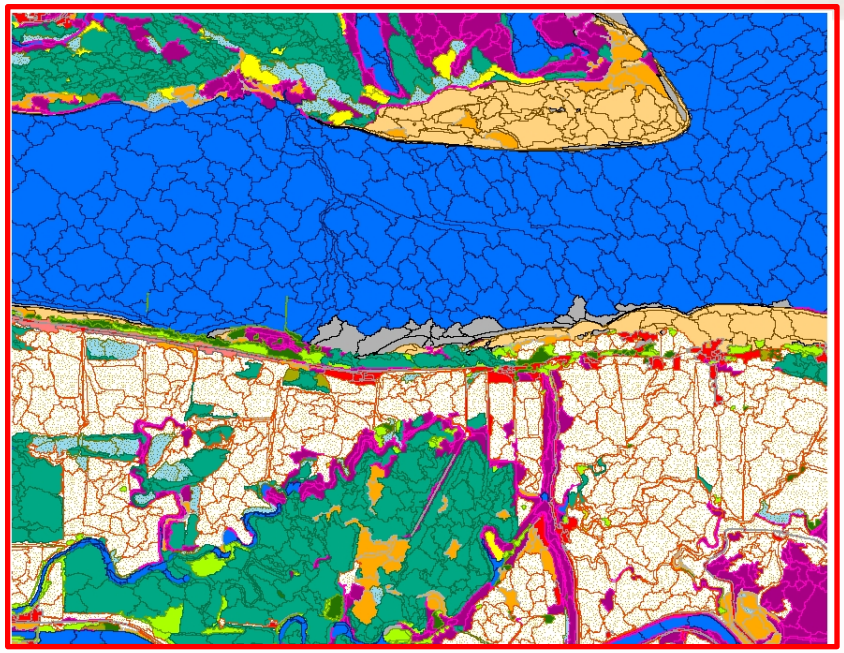

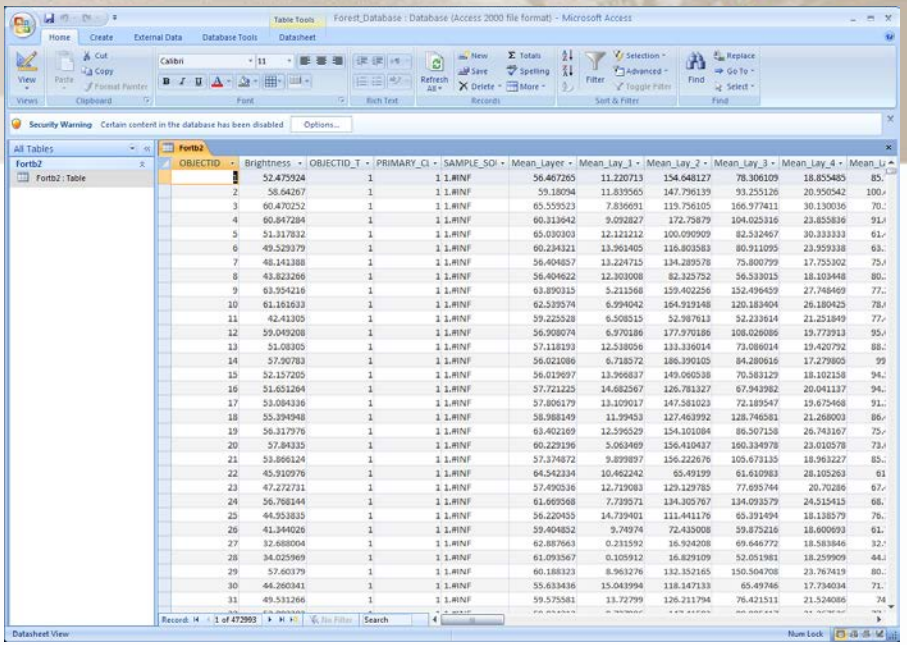

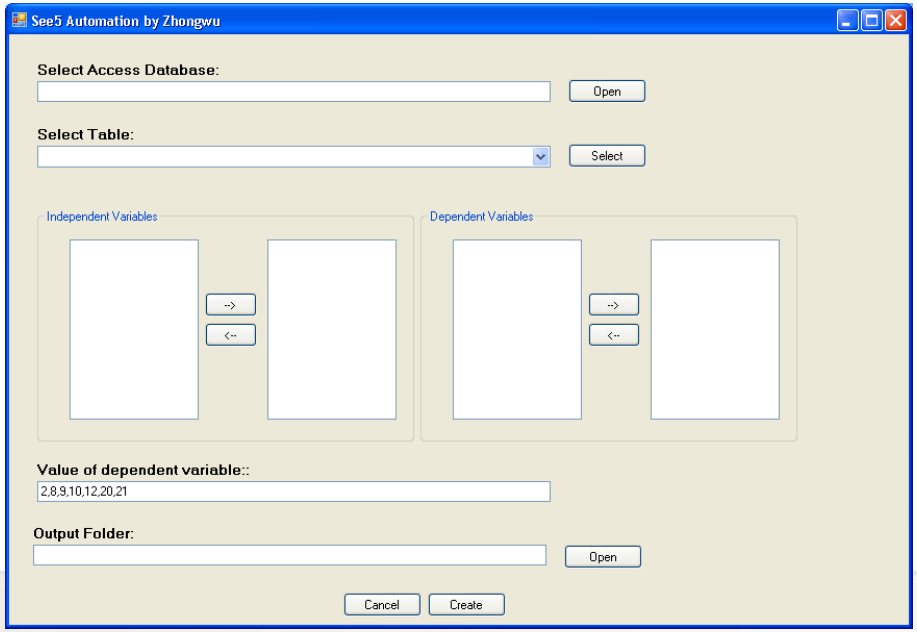

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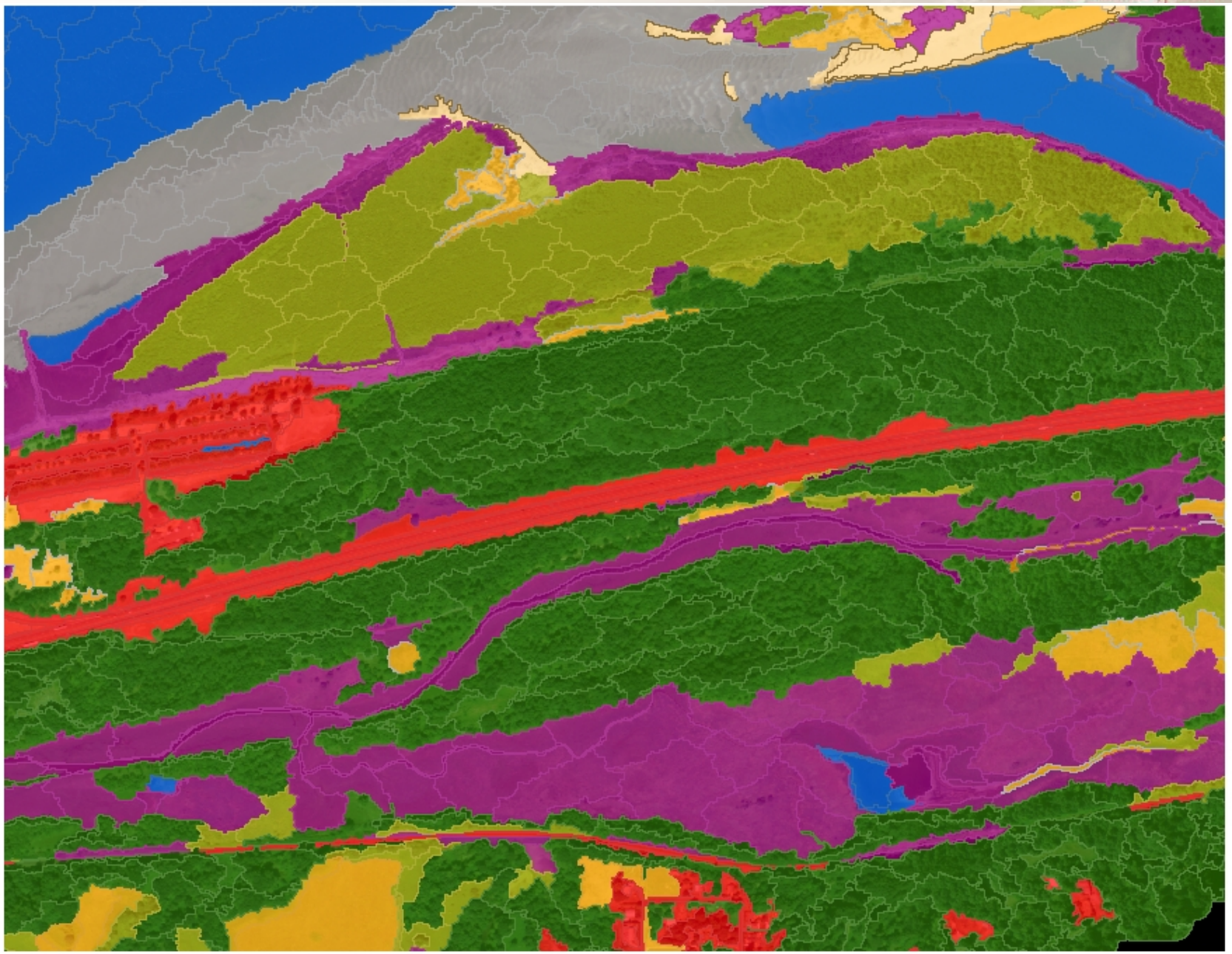
Cluster Busting and Modeling



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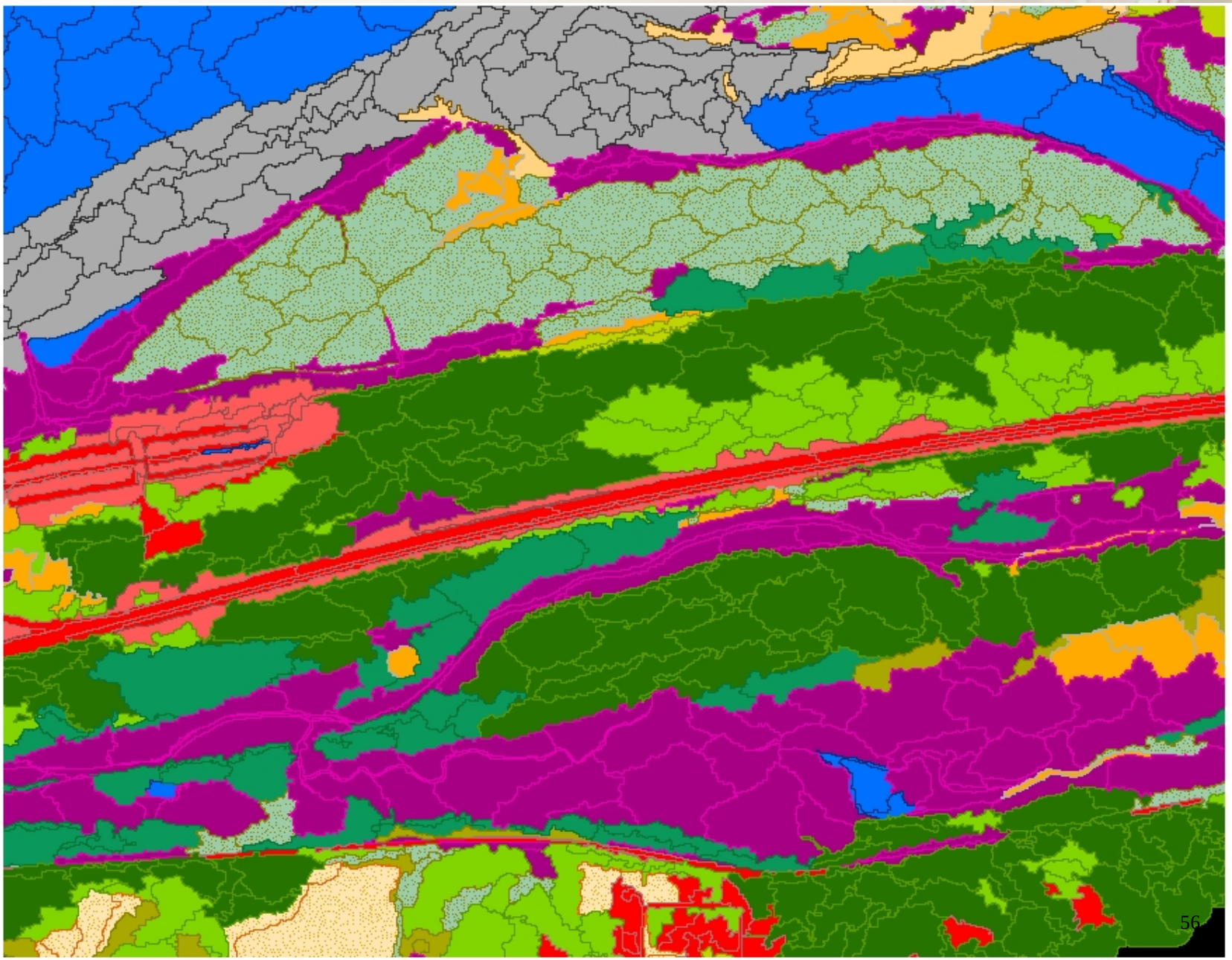
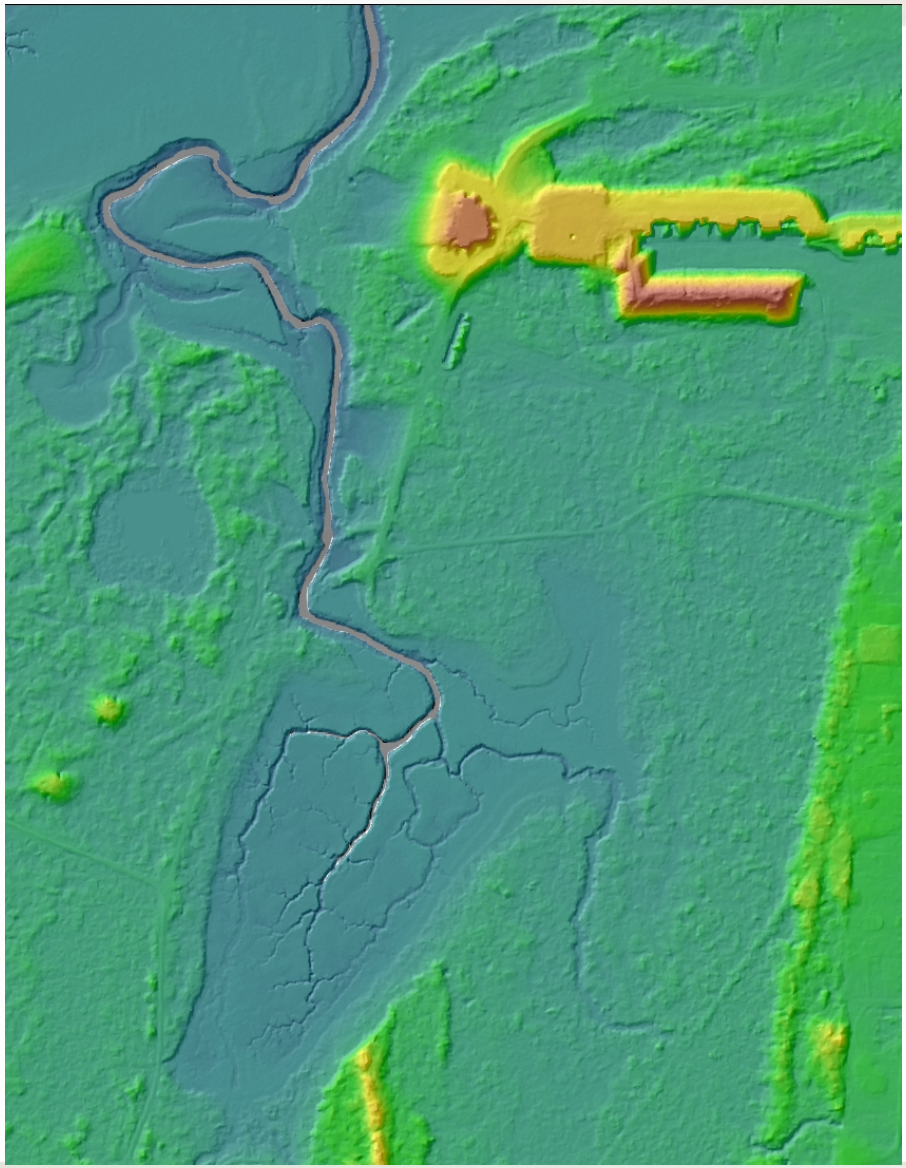
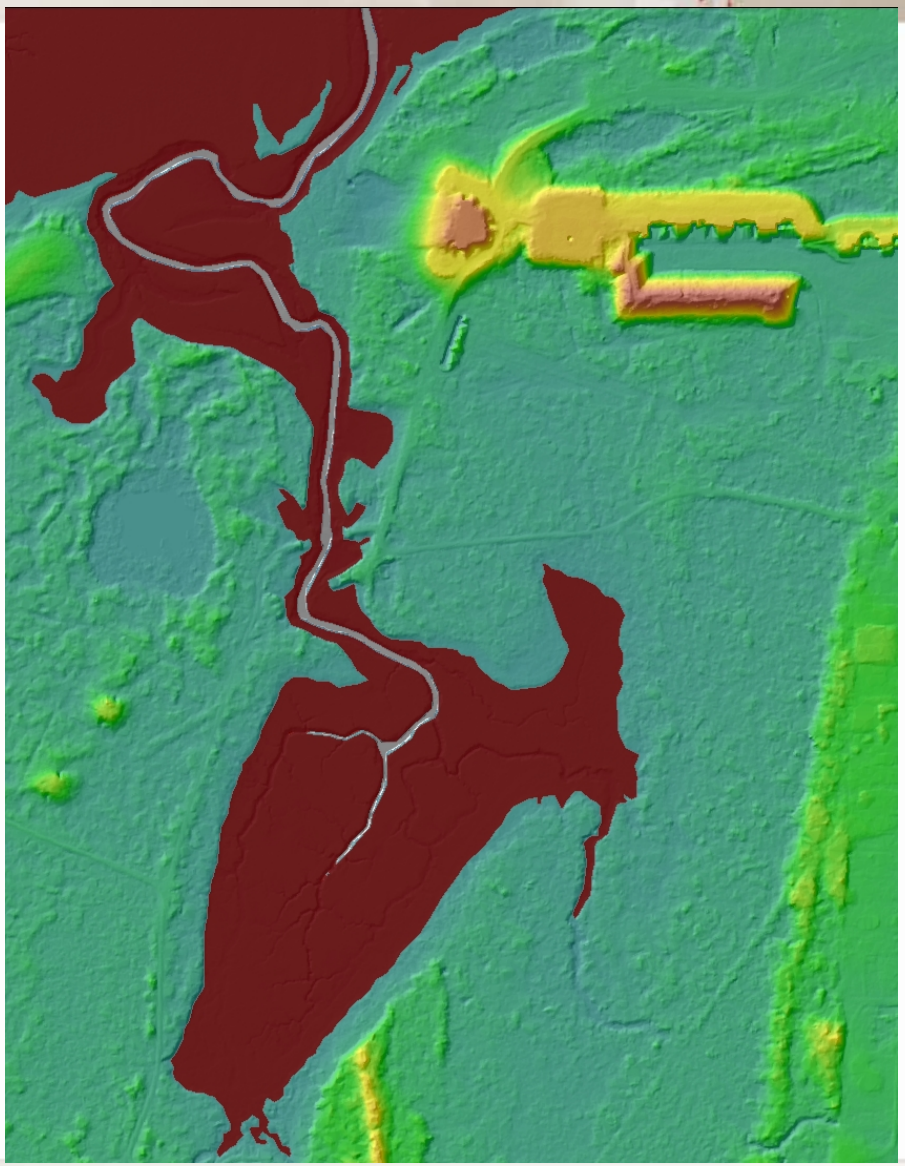


Tidal/Diked Layers





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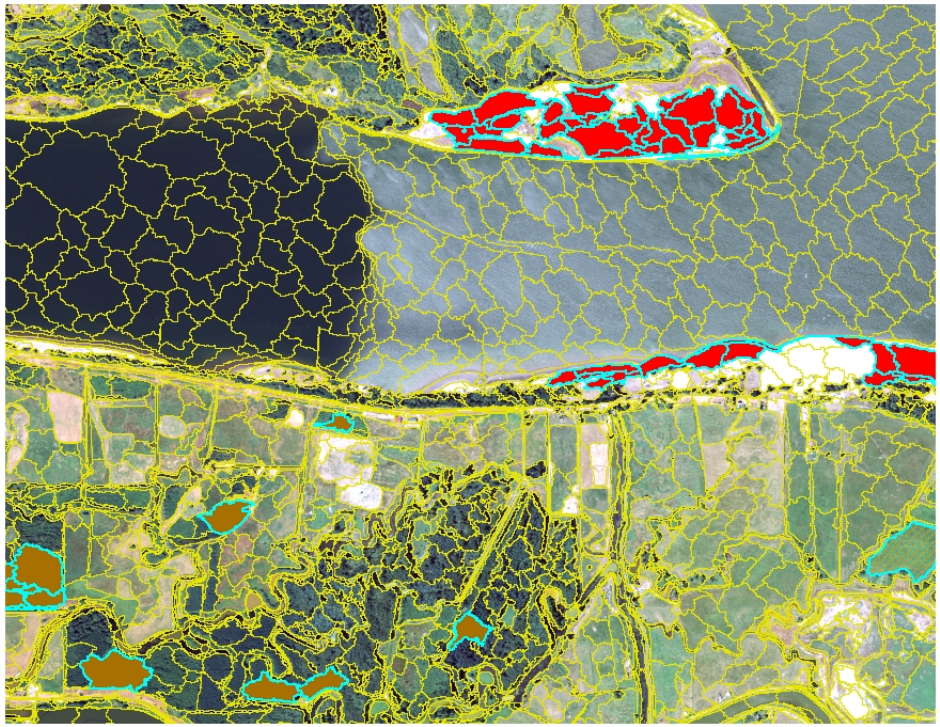
Left to do

- Additional Conditional Modeling / Editing
- Final Accuracy Assessment



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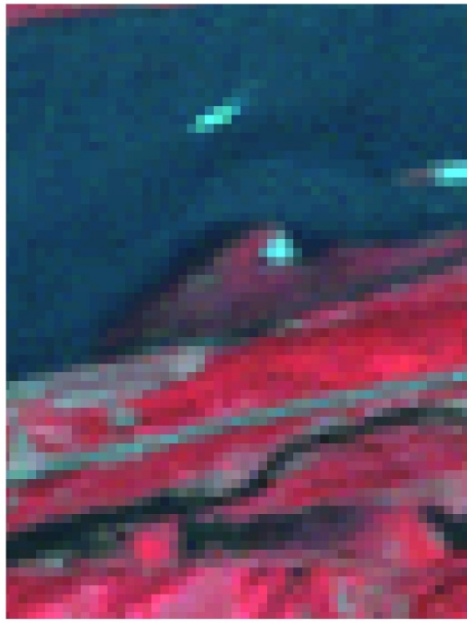
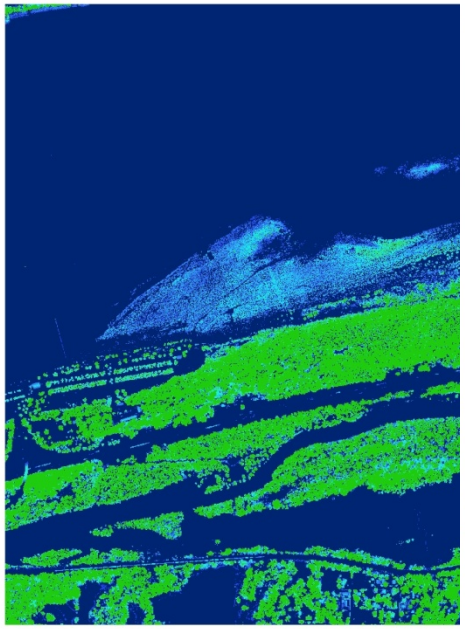
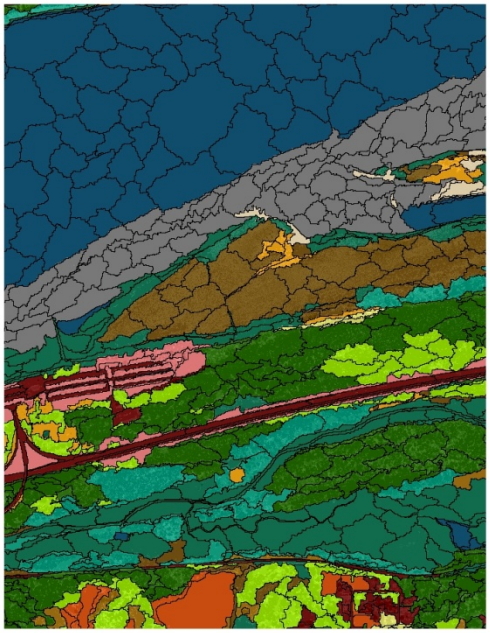
Future Steps

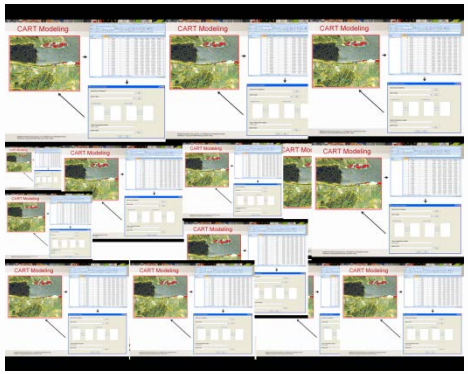
- Assess the predictive value of independent variables



Iterative CARTs

And math.



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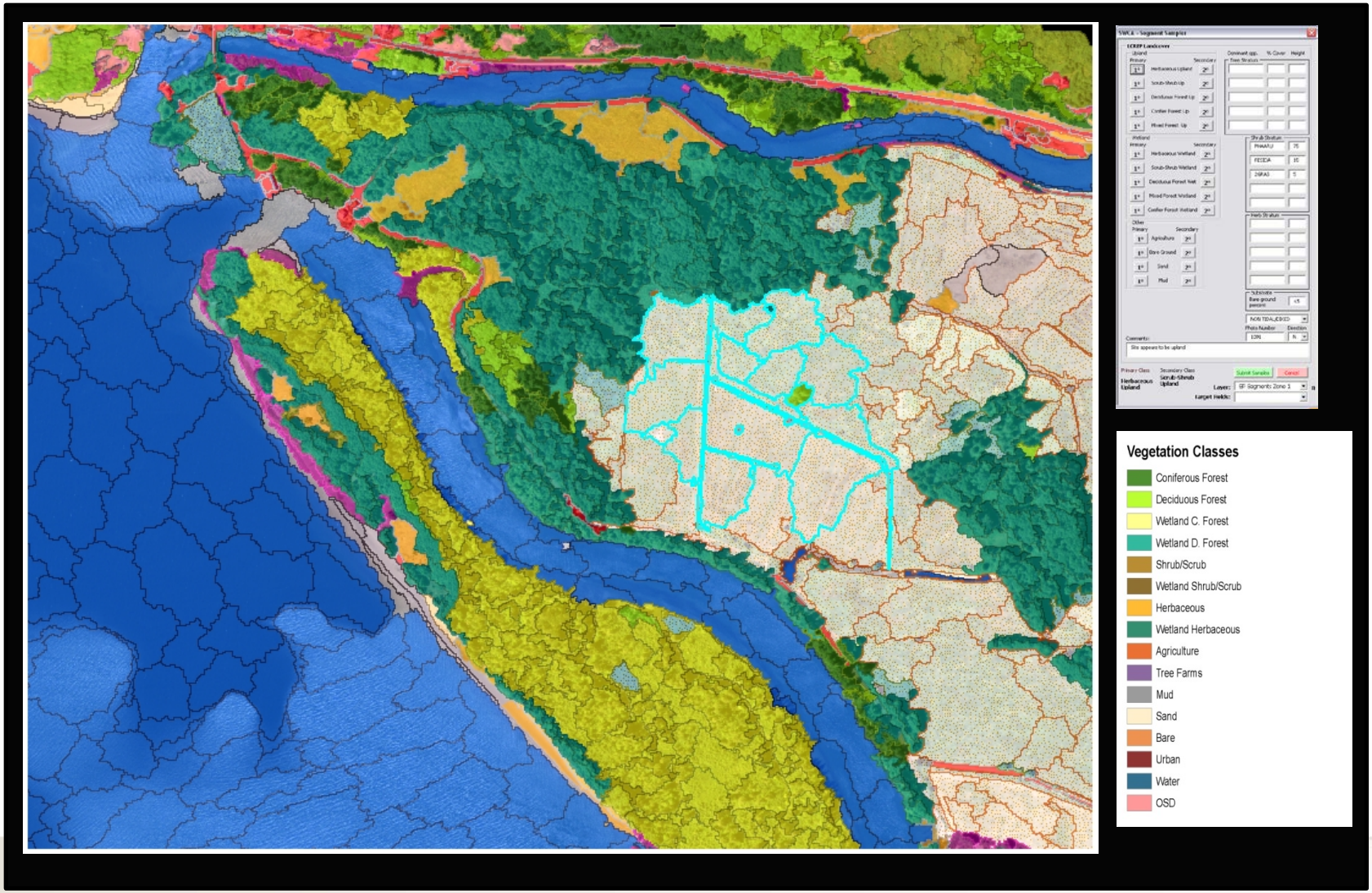
Future Steps

- Assess the predictive value of independent variables
- Web Map editing…Open LCREP Map…



Questions?