Floodplain Riparian Habitat Management

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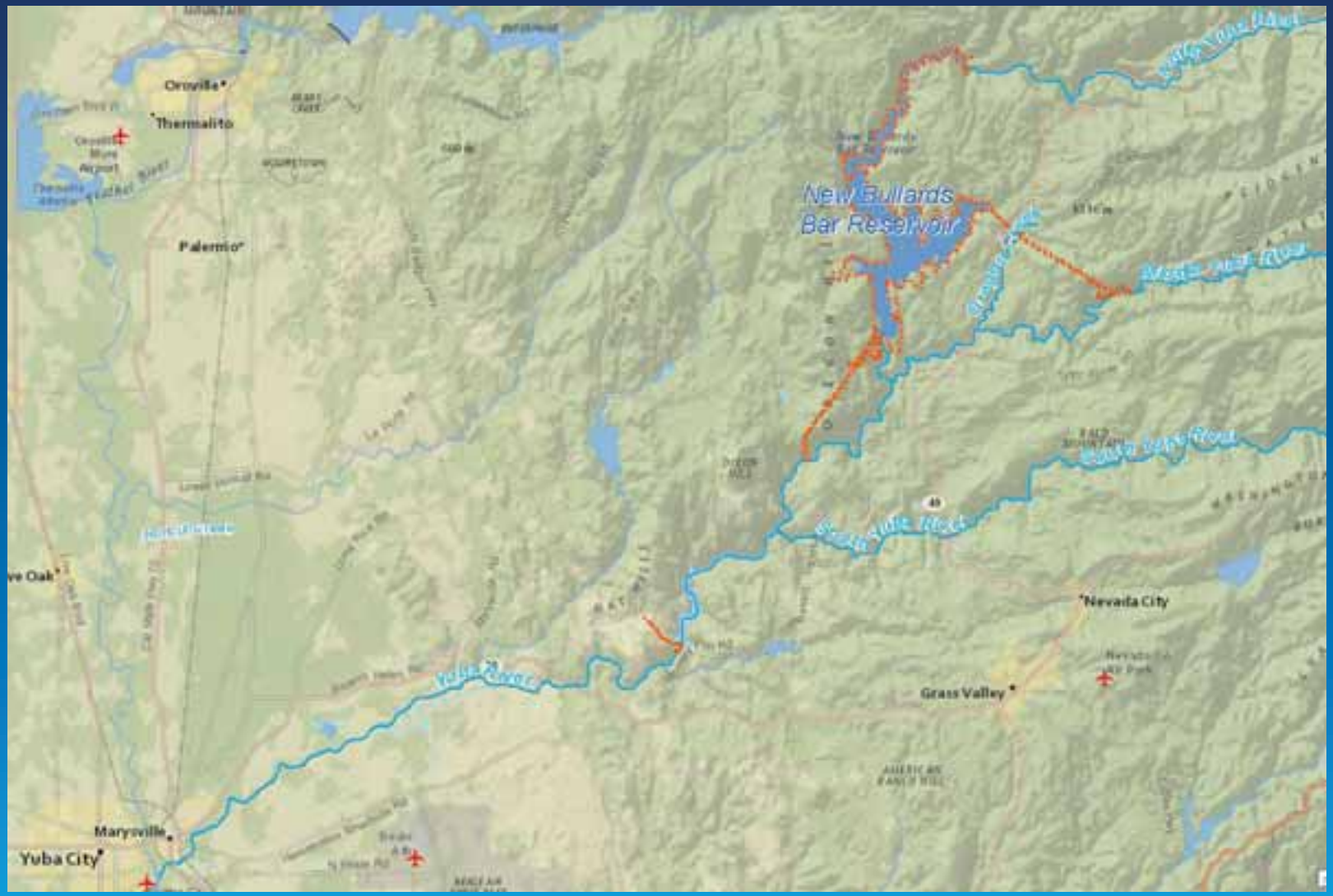
Project Overview

- **Yuba County Water Agency (YCWA), Yuba River Development Project FERC Relicensing**
- **http://www.ycwa-relicensing.com/default.aspx**
- **https://gisapps.hdrprojects.com/YCWA/index.html**

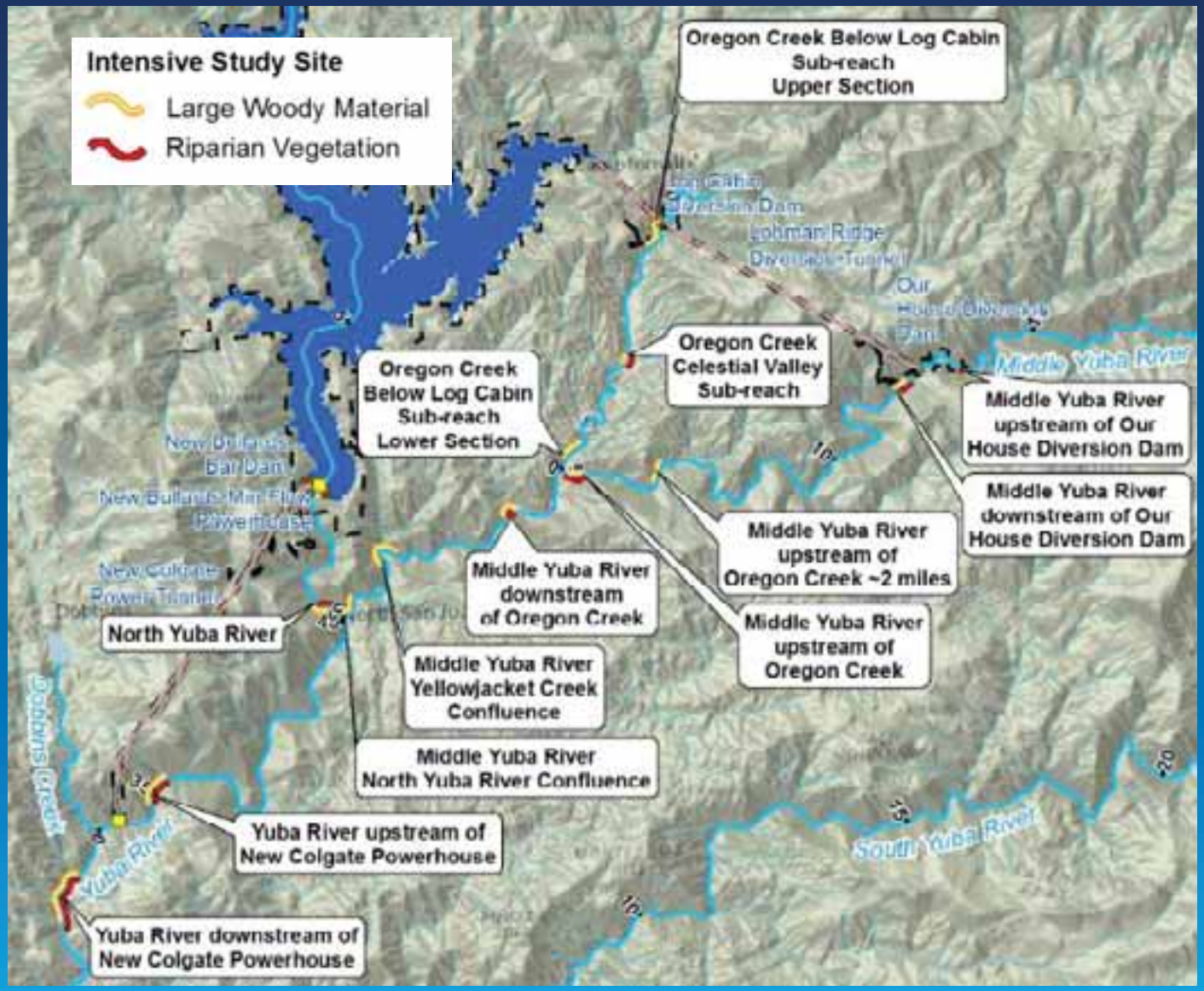
FERC Relicensing of Hydropower Projects

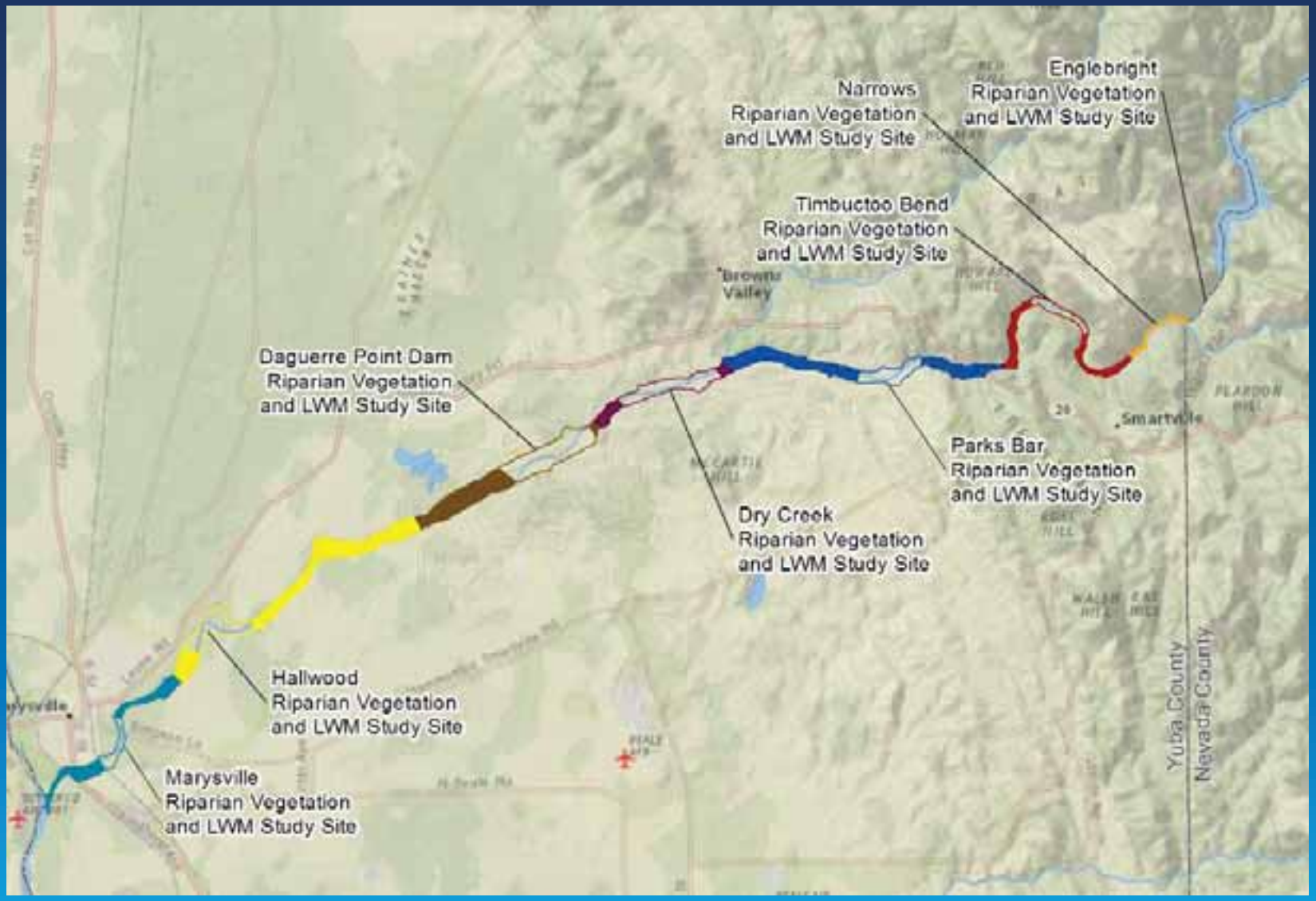
- Licenses are granted by Federal Energy Regulatory Commission (FERC) for hydropower projects and last from 30-50 years
- Licensing or Relicensing can take 5+ years to complete
  - Year 1 – gather existing data and identify data gaps
  - Year 2 & 3 – fill data gaps by completing studies
  - Year 4 – publish study reports
  - Year 5 – file application with FERC, including plans to manage resources
  - Year 5+ – negotiate management of resources with stakeholders (revise management plans and license application) and complete NEPA analysis


Oroville
Thermalito
Palermo
New Bullards Bar Reservoir
Nevada City
Grass Valley
Marysville
Yuba City

Riparian Studies

- How do current operations impact the riparian habitat downstream?
- Split into two studies
  - Above Englebright Reservoir
  - Below Englebright Reservoir
- Both studies had field components and desktop GIS analysis
- Only desktop GIS analysis will be discussed in detail today


Intensive Study Site
Large Woody Material
Riparian Vegetation
Oregon Creek Below Log Cabin Sub-reach Upper Section
Oregon Creek Below Log Cabin Sub-reach Lower Section
Oregon Creek Celestial Valley Sub-reach
Middle Yuba River upstream of Our House Diversion Dam
Middle Yuba River downstream of Our House Diversion Dam
Middle Yuba River upstream of Oregon Creek ~2 miles
Middle Yuba River upstream of Oregon Creek
Middle Yuba River downstream of Oregon Creek
North Yuba River
Middle Yuba River Yellowjacket Creek Confluence
Middle Yuba River North Yuba River Confluence
Yuba River upstream of New Colgate Powerhouse
Yuba River downstream of New Colgate Powerhouse
Middle Yuba River
South Yuba River
Lohman Ridge Diversion Tunnel
Our House Diversion Dam


Englebright
Riparian Vegetation
and LWM Study Site
Narrows
Riparian Vegetation
and LWM Study Site
Timbuctoo Bend
Riparian Vegetation
and LWM Study Site
Browns
Valley
Daguerre Point Dam
Riparian Vegetation
and LWM Study Site
Smartville
Parks Bar
Riparian Vegetation
and LWM Study Site
Dry Creek
Riparian Vegetation
and LWM Study Site
Hallwood
Riparian Vegetation
and LWM Study Site
Marysville
Riparian Vegetation
and LWM Study Site
Yuba County
Nevada County

GIS Analysis Completed to Support Studies Include:

- Historic photo comparison
- Riparian vegetation characterization (below Englebright only)

Historic Photo Comparison

- YCWA's New Bullards Bar Dam, Our House Diversion Dam, and Log Cabin Diversion Dam constructed 1968-1970
- Englebright Dam (USACE) constructed 1941

Above Englebright Reservoir

Assessment Site	Photoset Years						
	1937	1939	1952	1969	1993	1998	2009
Middle Yuba River Downstream of Oregon Creek	10/21	--	7/18	--	--	8/16	x
Middle Yuba River Upstream of Oregon Creek	9/22	--	7/22	--	--	8/16	x
Middle Yuba River Downstream of Our House Diversion Dam	--	--	--	8/3	7/9	8/31	x
Oregon Creek Celestial Valley Sub-reach	--	--	--	8/3	7/9	8/16	x
North Yuba River	--	7/7	7/22	--	--	9/12	x
Yuba River Upstream of New Colgate Powerhouse	--	6/30	--	8/3	--	9/12	x
Yuba River Downstream of New Colgate Powerhouse	--	6/30	--	--	--	9/12	x

Below Englebright Reservoir

Assessment Site	Photoset Years				
	1937	1947	1970	1987	2010
Marysville	X	2/22/47	7/13/1970	6/29/1987	7/12/10
Hallwood	--	2/22/47	7/13/1970	7/14/1987	7/12/10
Dry Creek	--	2/22/47	7/13/1970	7/14/1987	7/12/10
Daguerre Point Dam	--	2/22/47	7/13/1970	6/29/1987	7/12/10
Parks Bar	--	2/22/47	7/13/1970	6/19/1987	7/12/10 and 7/13/10
Timbuctoo Bend	X	2/22/47	7/13/1970	6/19/1987	7/13/10
Narrows	X	2/22/47	--	6/19/1987	7/13/10

Historic Aerial Photo Analysis

- **Workflow**
  - **Use combination of supervised classification (ENVI EX and Esri Image Analysis) and heads up digitizing at scale 1:20,000**
- **Challenges**
  - **Several photo years not georeferenced or orthorectified**
- **Results**
  - **Quantitative and qualitative analysis completed by riparian scientists in the context of historic flow record**

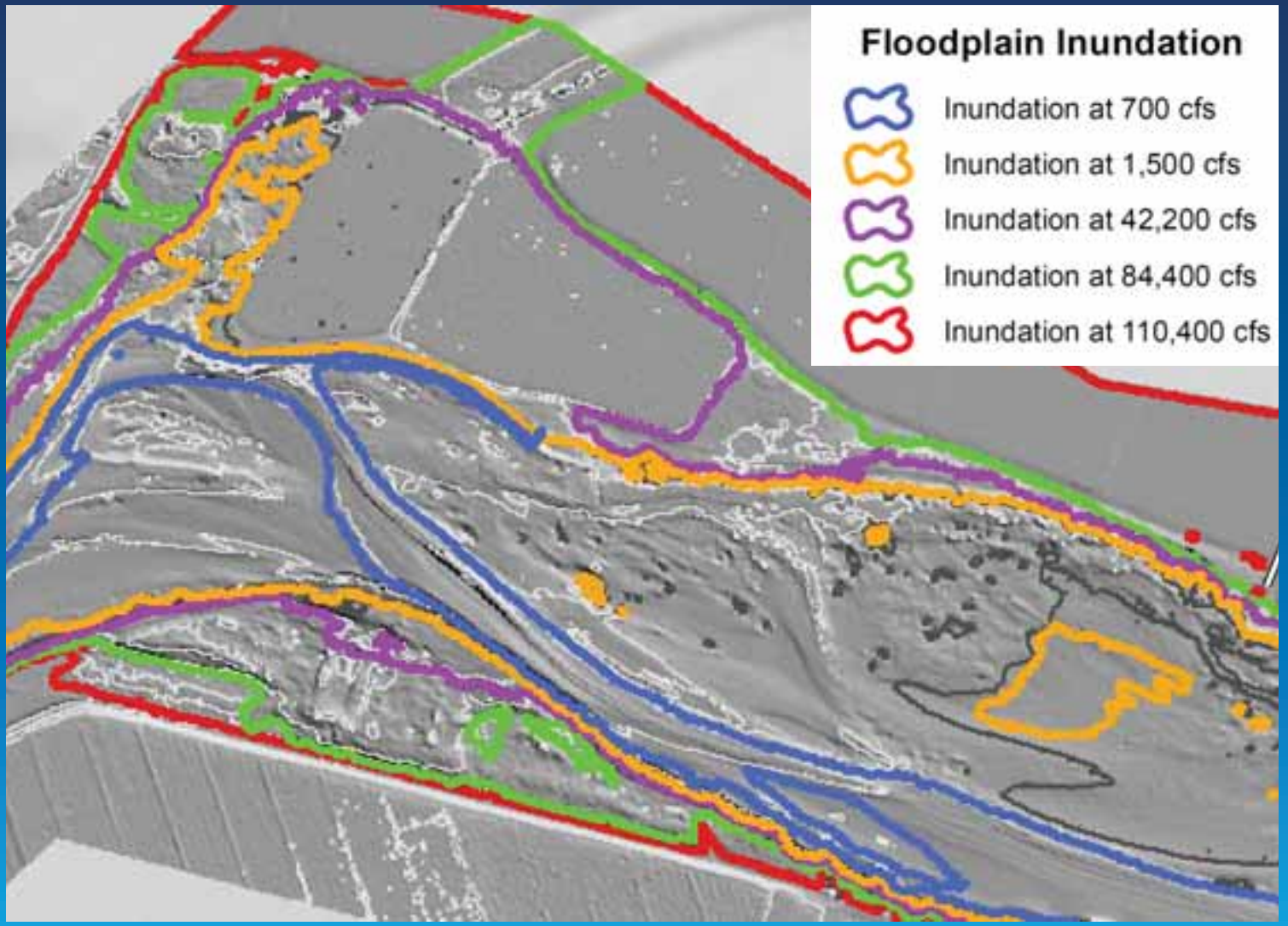
Below Englebright Vegetation Mapping

- Extensive data collected for the Yuba River Accord River Management Team (RMT)
  - http://www.yubaaccordrmt.com/default.htm
- RMT funded work by Dr. Greg Pasternack at UC Davis to build a detailed 2D hydraulic model of reach from Englebright Reservoir to confluence with the Sacramento River
  - http://www.amazon.com/Modeling-Ecohydraulic-Analysis-Gregory-Pasternack/dp/1466320095
- RMT funded work by Watershed Sciences to do advanced vegetation classification using LiDAR data

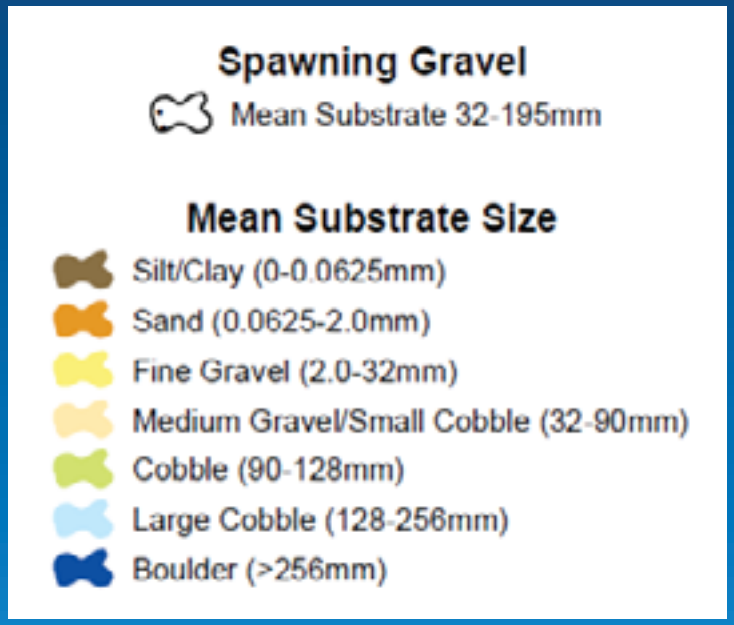
RMT Data Summary

- From Dr. Greg Pasternack
  - Detailed DTM developed from LiDAR, terrestrial, and bathymetric survey
  - Wetted area rasters for a range of modeled flows (SRH-2D) from 300 cfs to 110,400 cfs
  - Mean substrate size raster
  - Geomorphic region polygons
  - Scour/deposition raster
- From Watershed Sciences
  - Vegetation segmentation boundaries of LiDAR derived individual tree crown extents with tree species and canopy height attributes

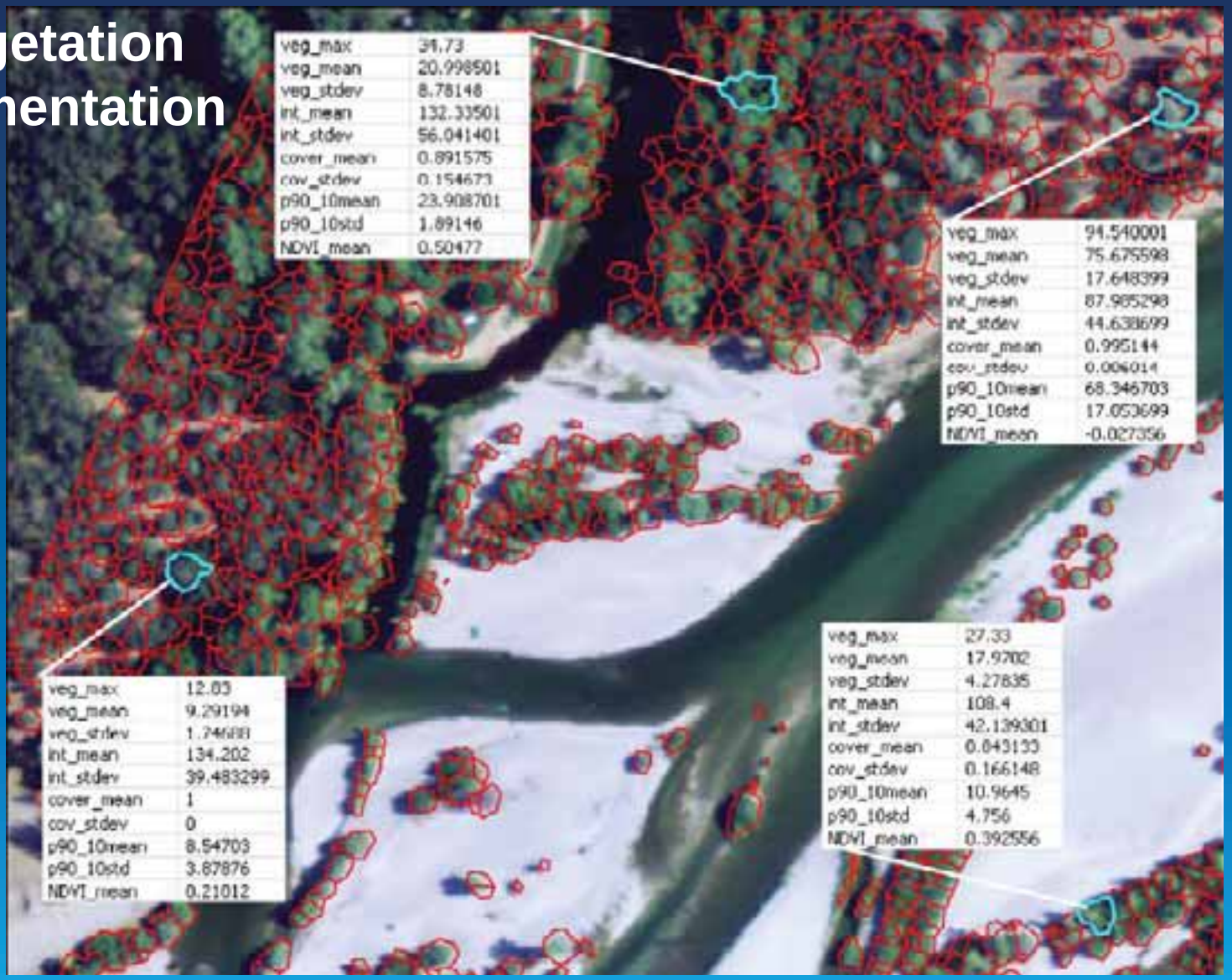
DTM with Wetted Areas

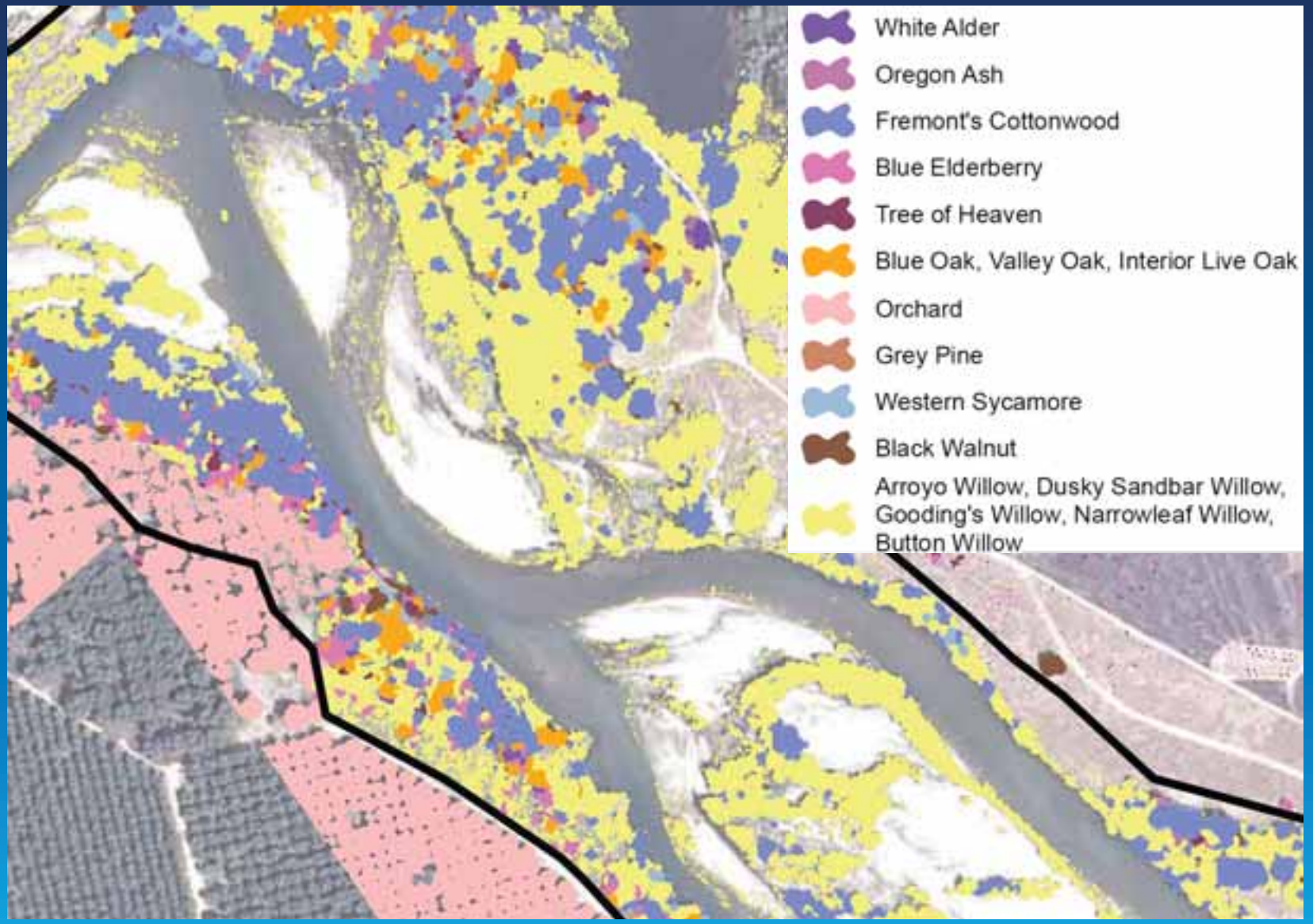


Morphological Units & Mean Substrate



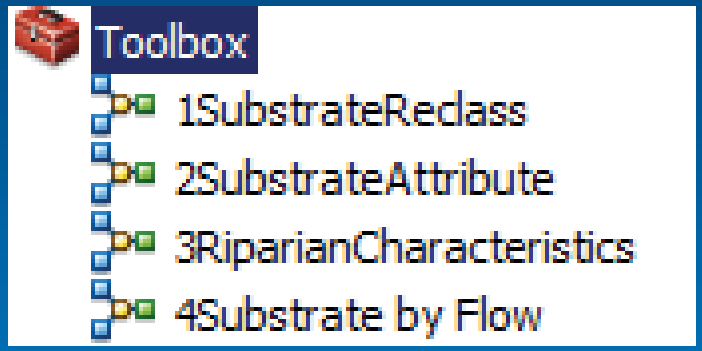
Vegetation Segmentation




White Alder
Oregon Ash
Fremont's Cottonwood
Blue Elderberry
Tree of Heaven
Blue Oak, Valley Oak, Interior Live Oak
Orchard
Grey Pine
Western Sycamore
Black Walnut
Arroyo Willow, Dusky Sandbar Willow, Gooding's Willow, Narrowleaf Willow, Button Willow

GIS Overlay Analysis

- **Workflow**
  - Make flow polygon file
  - Series of GIS models to complete analysis
  - Export results to Excel for pivot table
  - Develop interactive PDF map
- **Challenges**
  - Large number of large data sets
  - Difficult to communicate so much information!
- **Results**
  - Pivot table and layered PDF map by which riparian scientist could explore and use data to develop report



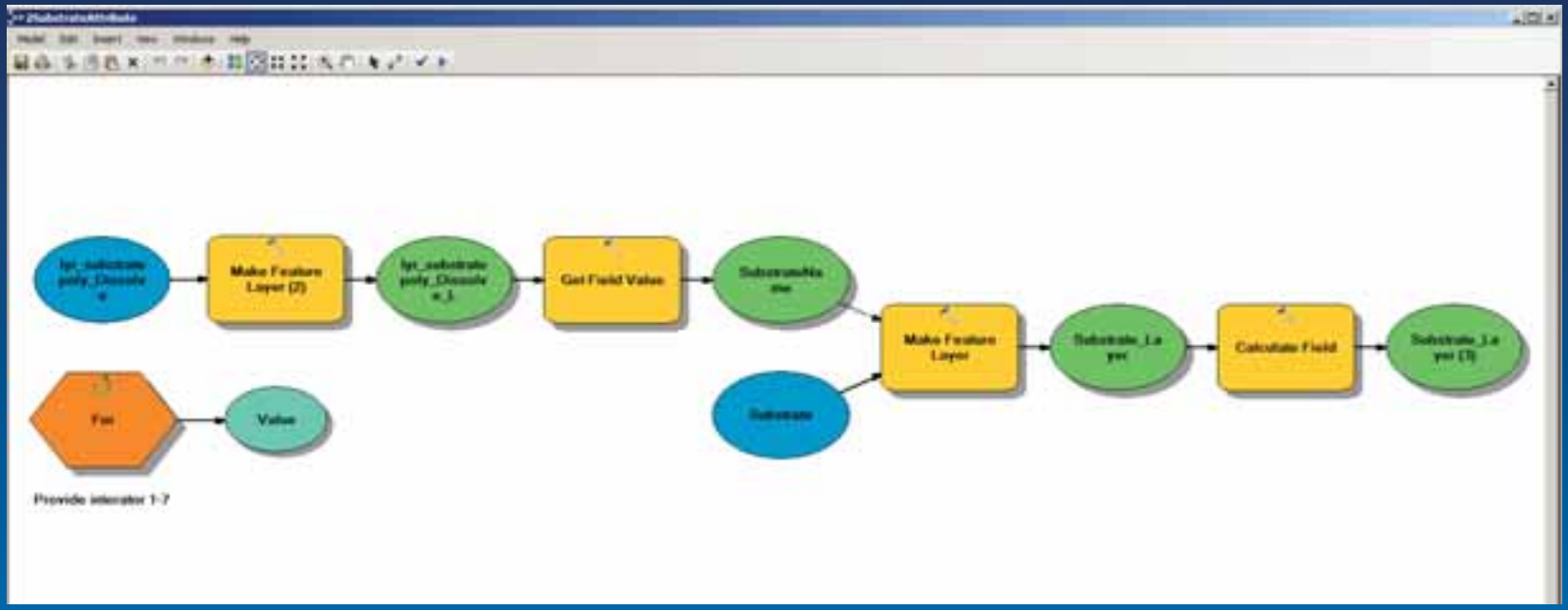


Table 3.3-5. Association between the area of canopy (ft²) of white alder (*Alnus rhombifolia*), cottonwood (*Populus fremontii*), Western sycamore (*Platanus racemosa*), and willow (*Salix* spp.) and substrate size.

Substrate Size[1]	White alder (*Alnus rhombifolia*)[2]		Fremont's cottonwood (*Populus fremontii*)		Western sycamore (*Platanus racemosa*)		Willows (*Salix lasiolepis, S. melanopsis, S. gooddingii, S. exigua, Cephalanthus occidentalis*)	
	Canopy/ Cover Area (ft²)	% of Canopy/Cover White Alder Area	Canopy/ Cover Area (ft²)	% of Canopy/Cover Cottonwood Area	Canopy/ Cover Area (ft²)	% of Canopy/Cover Western sycamore Area	Canopy/ Cover Area (ft²)	% of Canopy/Cover Willow Area
Boulder (>256mm)	546	13.8%	720	0.0%	0	0.0%	17,499	0.3%
Cobble (90-128mm)	3,946	8.3%	106,941	3.5%	16,775	6.7%	635,059	11.2%
Fine Gravel (2.0-32mm)	490	1.0%	61,372	2.0%	5,631	2.2%	99,064	1.7%
Large Cobble (128-256mm)	453	1.0%	24,310	0.8%	6,169	2.5%	196,474	3.5%
Medium Gravel/Small Cobble (32-90mm)	41,717	87.6%	2,810,614	93.1%	220,378	87.6%	4,699,122	82.9%
Sand (0.0625-2.0mm)	335	0.7%	6,602	0.2%	2,019	0.8%	8,366	0.1%
No Data	114	0.2%	7,243	0.2%	681	0.3%	13,465	0.2%

[1] Substrate information derived from Pasternack (2010).
[2] Vegetation mapping data derived from WSI (2012).

DEMO

(time permitting)

- **Questions?**

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