

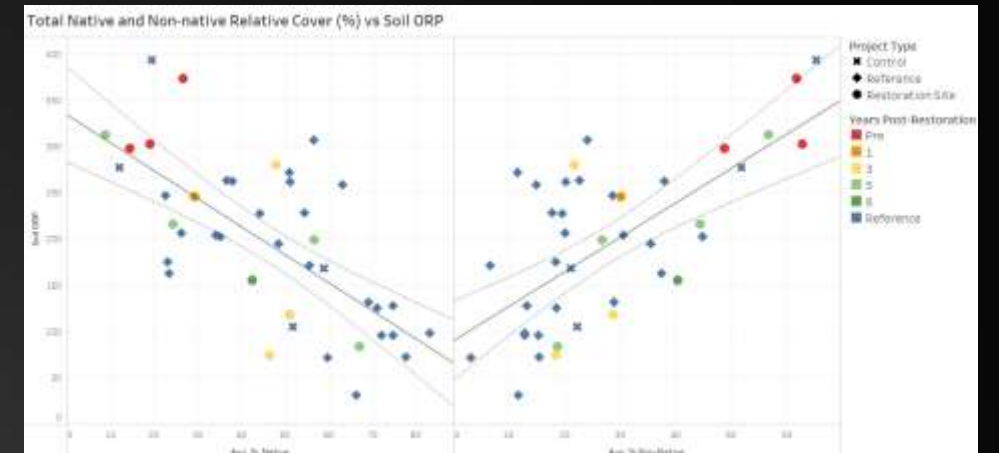
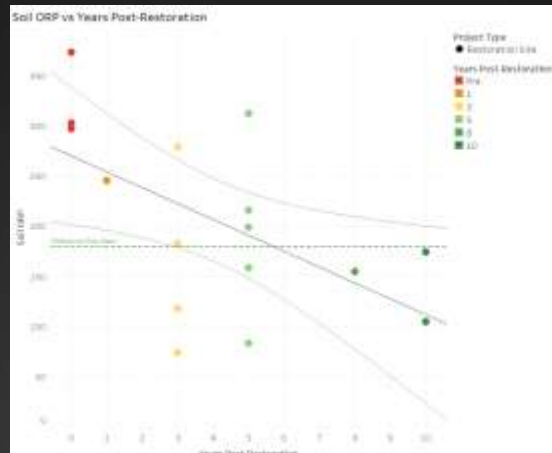
Visualizing and Analyzing 10 years of Wetland Habitat Monitoring Data in Tableau

MAY 16-18, 2022

COLUMBIA RIVER ESTUARY CONFERENCE



IAN EDGAR
SARAH KIDD, PHD
SNEHA RAO



OUTLINE OF TALK

- ▶ What Data do we have?
- ▶ Background Behind Tableau
- ▶ Overview of Tableau as a Data management Platform
- ▶ Transitioning into Tableau
- ▶ Next Steps



TWO MONITORING PROGRAMS

Ecosystem Monitoring Program (EMP)

Status and trends monitoring of ecosystem condition
Provides basic understanding, fills knowledge gaps on estuarine - tidal freshwater section of lower river
Provides suite of reference sites for AEM

Action Effectiveness Monitoring & Research Program (AEMR)

Allows evaluation of whether restoration actions achieved the goals of the project
Provides understanding of benefits of restoration actions
Depends on EMP for evaluation of results



ECOSYSTEM MONITORING PROGRAM

SALMONID HABITAT MONITORING PROGRAMS

EMP = Ecosystem Monitoring Program - *Methods [here](#)*

- ✓ Mainstem and Abiotic Site Conditions - **Joe Needoba (OHSU)**
- ✓ Habitat Structure, Hydrology, Soils, Sediment Accretion, Detritus - **Sarah Kidd, Sneha Rao, Ian Edgar (LCEP)**
- ✓ Food Web, e.g., Planktonic and Macrophyte contributions to Juvenile Salmon Food Web - **Tawnya Peterson (OHSU)**
- ✓ Fish Prey and Macroinvertebrate Community - **Jeff Cordell, Jason Toft, Kerry Accola (UW)**
- ✓ Fish Community and Occurrence - **Curtis Roegner, Regan McNatt, Susan Hinton, Jeff Grote, Paul Chittaro, Dan Lomax (NOAA)**
- ✓ Critical Field, Lab Support, UAV pilot - **April Silva, Narayan Elasmr (CREST)**



ACTION EFFECTIVENESS MONITORING RESEARCH PROGRAM

AEMR = Selected sites (Level 2) receive Full Habitat surveys – Pre, 1, 3, 5 and 10 yrs. post-restoration – Methods [here](#)
All sites (Level 3) receive Basic Hydrology and Sediment Accretion Monitoring Years 1-5, 10 yrs. post-restoration

- ✓ **Habitat Structure, Hydrology, Soils, Sediment Accretion** - Sarah Kidd, Sneha Rao, Ian Edgar (LCEP)
- ✓ *Spot Check of **Macroinvertebrate Community*** - Jeff Cordell, Jason Toft, Kerry Accola (UW)
- ✓ *Spot Checks at Year 5 and 10 Post - **Fish Community and Occurrence*** - Curtis Roegner, Regan McNatt, Susan Hinton, Jeff Grote, Paul Chittaro, Dan Lomax (NOAA)
- ✓ *Critical Field, Lab Support, UAV pilot* - April Silva, Narayan Elasmr (CREST)



Need for a proper Data Management System




 75+ Sites with over a decade of data


Excluding drone datasets, over 10gb of raw data.
>1tb of drone data

 Habitat

Hydrology
• 10+ million datapoints
Sediment Accretion
• 8000+ datapoints

 Food Web

Vegetation and Soil
• 60,000+ datapoints
Biomass
• 20,000+ datapoints

 Drone

Each flight >1000 photos
• <50cm pixels
• Veg classifications, habitat opportunity, etc

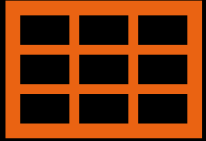
 Animals

Macroinvertebrates
• 10,000+ datapoints
Fish
• 40,000+ datapoints

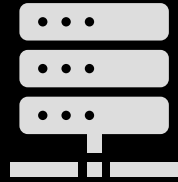
 Others

Zooplankton
Isotope analyses
Nutrients

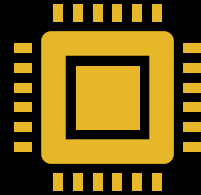
SOFTWARE OPTIONS AND CONSIDERATIONS



Excel



MS Access, SQL, ArcPro,
ArcCatalog - etc.



R, Python, MATLAB, SASS,
Exploratory, etc.



Tableau

- **Data Limits** – What data limits are imposed (such as Excel's row limits)
- **Database Capacity** – Does it provide a structure for storing and connecting data?
- **Accessibility and Ease of Use** – How hard is it for someone to use?
- **QA/QC, Analysis, Visualization Capacity** – Can you edit/analyze/graph your data?
- **Mapping and Geospatial Analysis** – Can you make maps and geolocate your data?
- **Collaboration** – Easy to share with others? (Proprietary data formats? Software requirements?)
- **Online/Desktop Data Sharing** – How easy is it to access and present data – online data hosting?
- **Costs** - How expensive is the software? Does everyone need to purchase the software to collaborate?



Tableau



Data Visualization
Software with advanced **analysis** capabilities

Primarily used by finance sector; however, rapidly being adopted by the **scientific** communities

Emphasizes **seeing** and **understanding** data insights for both the analyst and the audience

The “**Next Step**” in the world of visualization



Yeah, Tableau is the greatest thing in the world, except for a nice MLT—mutton, lettuce and tomato sandwich, when the mutton is nice and lean, and the tomato is ripe...

TRANSITIONING INTO TABLEAU

- Data Structure and Database Connections
- Tableau Prep
- Tableau Basics
- Tableau Georeferencing
- Tableau End Points



Data Structure (Relational Tables) or Database Connections



- ▶ Partial database structure
 - ▶ We use relational tables
 - ▶ Mixture of CSV files, Excel files, and shapefiles
 - ▶ Publish to Tableau Online server
- ▶ Options to connect to servers
 - ▶ Tableau Online servers
 - ▶ Any other 'industry' server
 - ▶ Redshift, Presto, MySQL, Oracle, Esri, Snowflake, etc

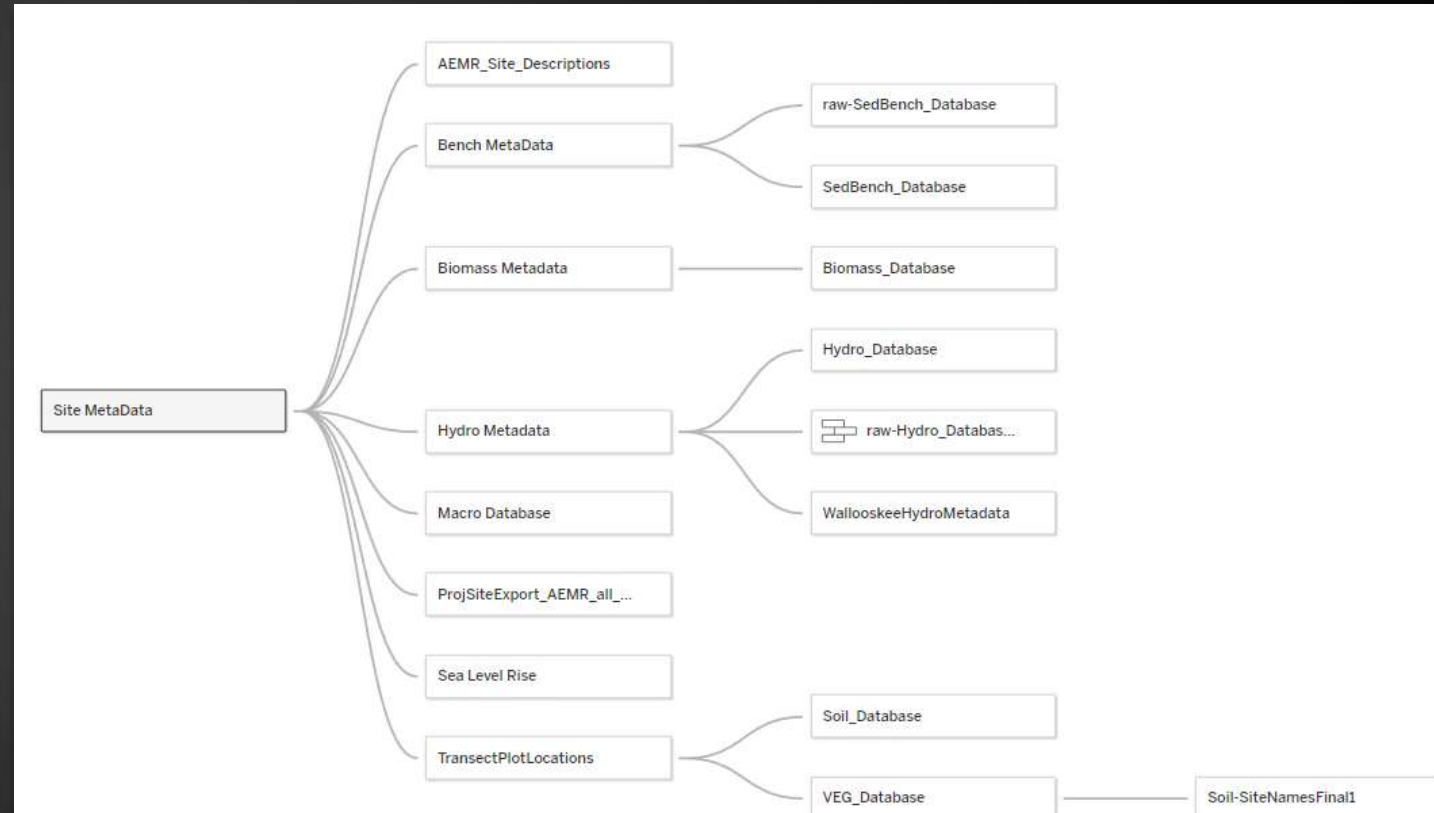
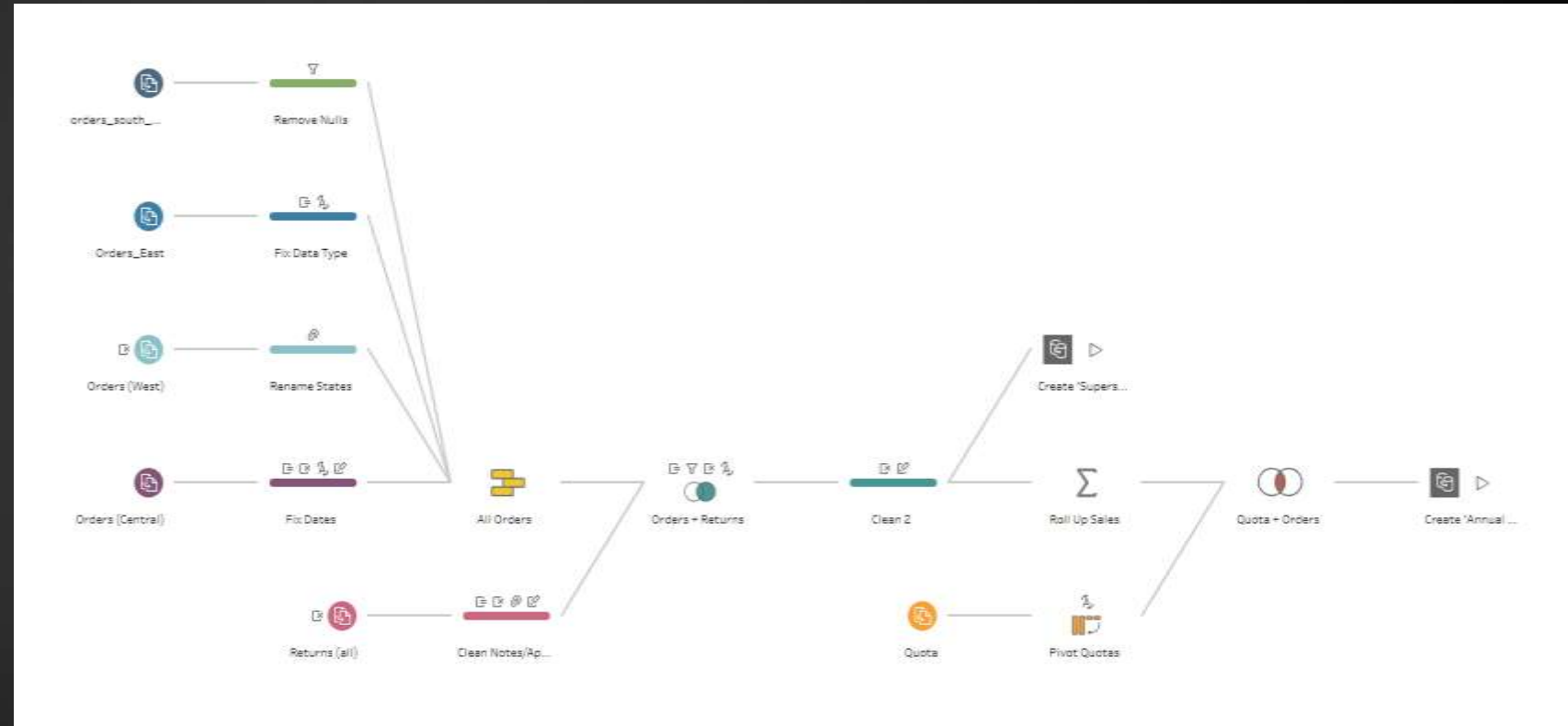
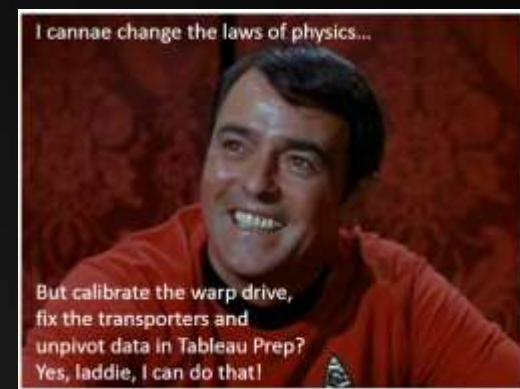


Tableau Prep

- ▶ Performance Improvements
- ▶ Creates a hyper file
 - ▶ Tableau's database system
 - ▶ Built on PostgreSQL
- ▶ As complex or simple as desired
 - ▶ Contains cleaning, unions, joins, pivots, aggregations, scripts, predictions, and exporting to several formats



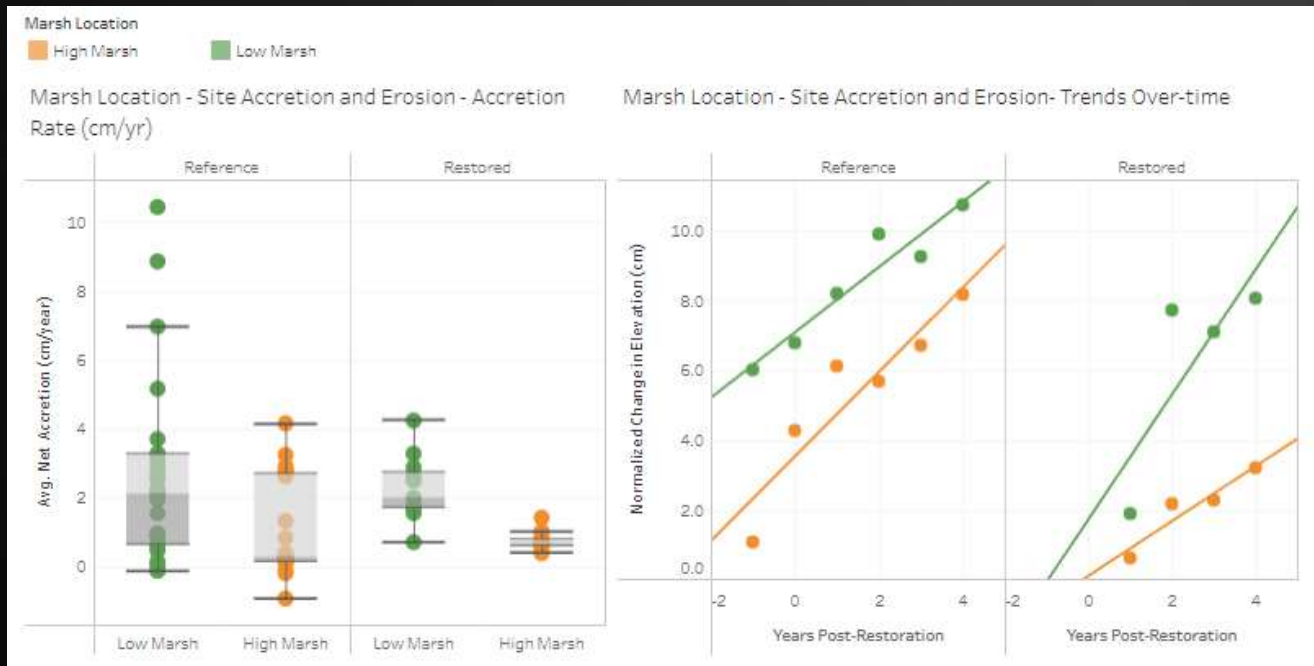
Tableau

- ▶ Tableau combined georeferencing with visualization
- ▶ Simple graphs are trivial to create
- ▶ One can control the level of aggregation
- ▶ Full coding integration with R and python

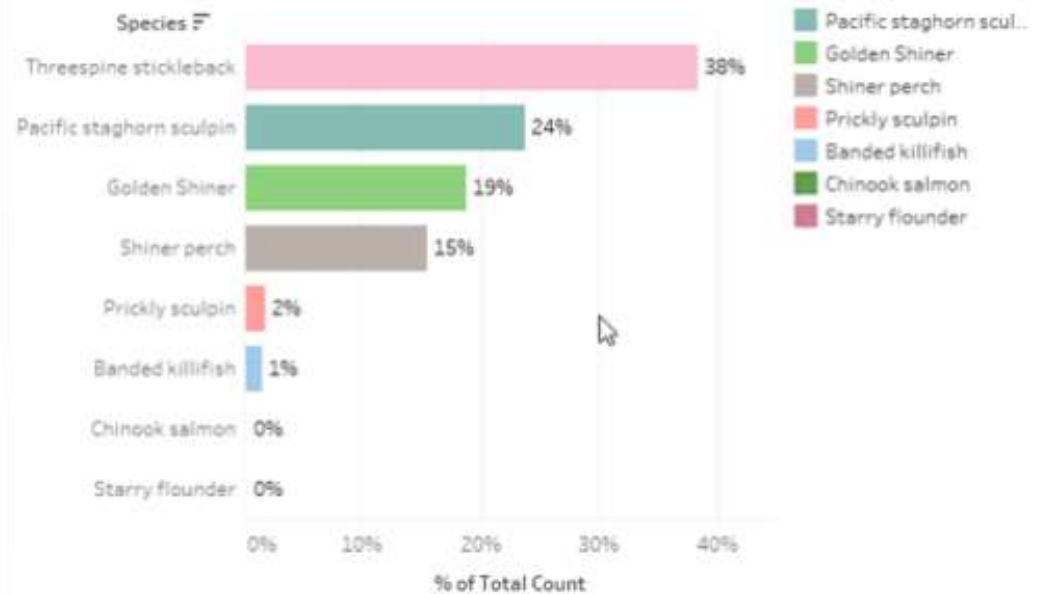


Fish Community Composition

Fish Sampling Map - Wallacut Slough



Fish Community Composition at Year 5 Post-restoration



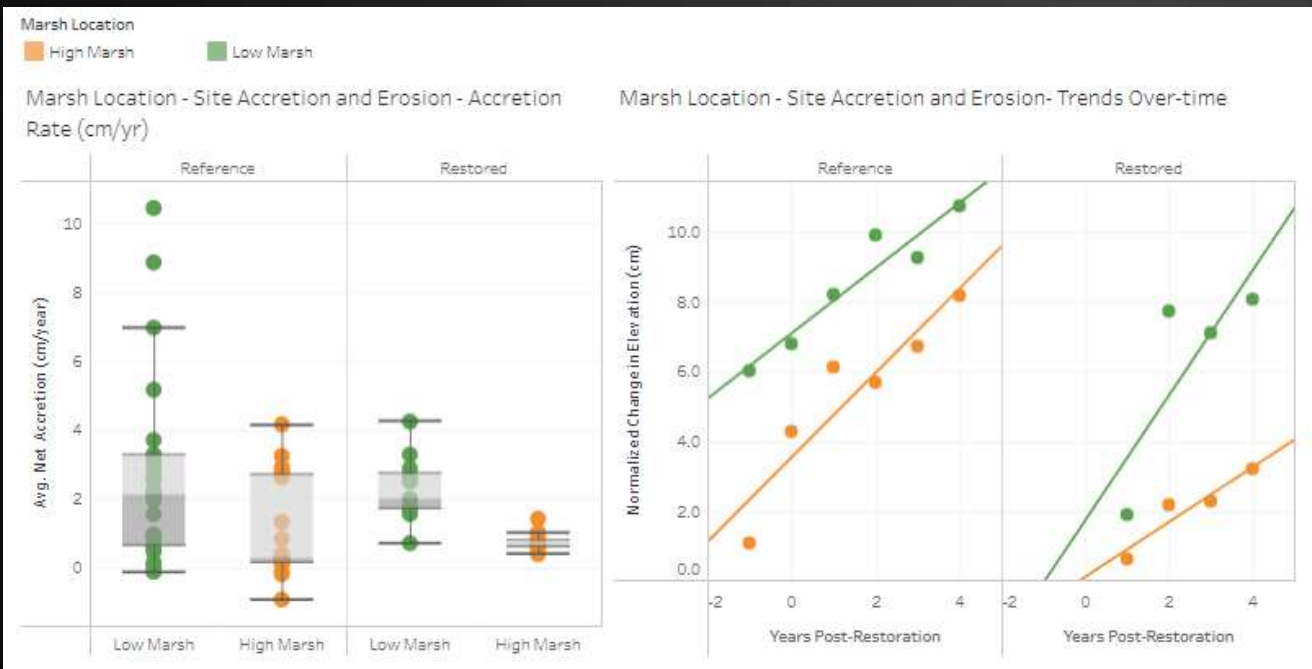
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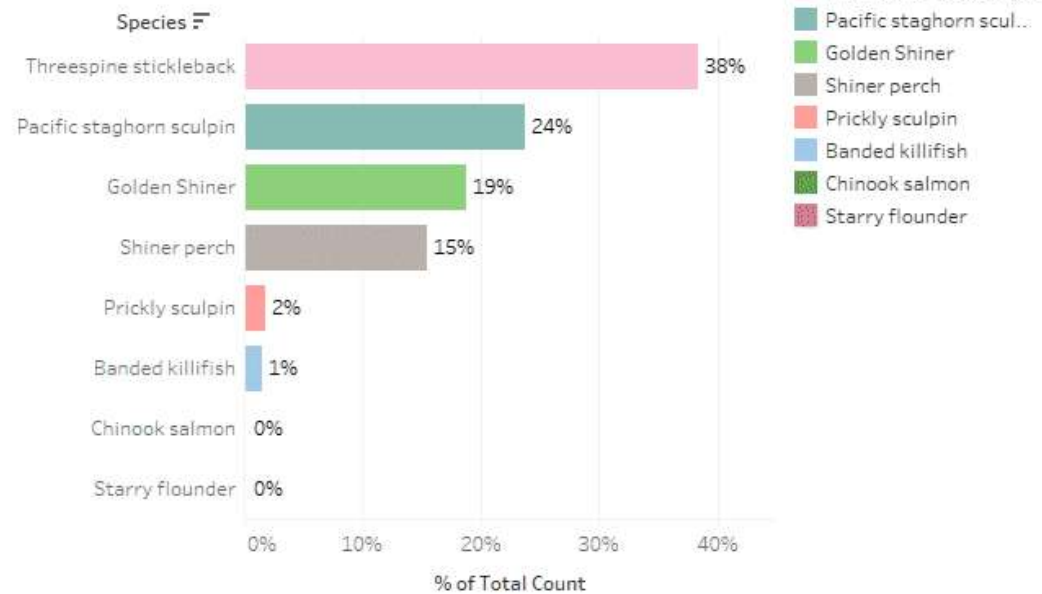


Fish Community Composition

Fish Sampling Map - Wallacut Slough



Fish Community Composition at Year 5 Post-restoration



Georeferenced Analyses

- ▶ Custom mapping using Mapbox and ArcGIS
- ▶ Full Support with shapefiles and rasters
- ▶ And more – the sky is the limit

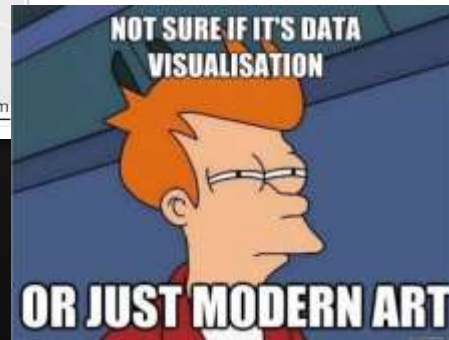
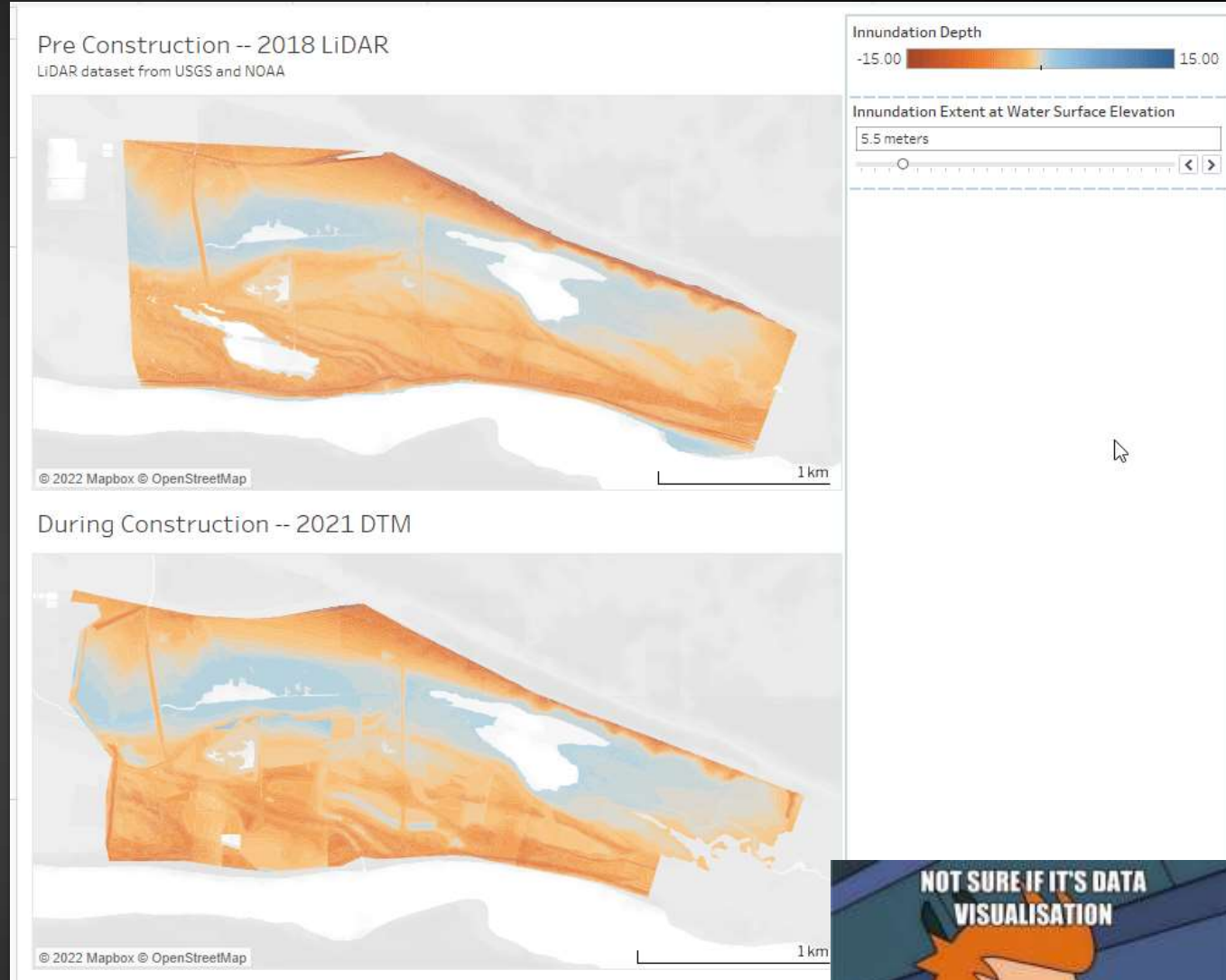


Tableau End Points

- ▶ Online Dashboards to compliment reports and share data
 - ▶ See 2022 AEMR Report
- ▶ Private or public status
- ▶ Allows sharing of data
- ▶ Tableau Public has a thriving ecosystem of visionaries



Action Effectiveness Monitoring and Research Dashboards

Wetland Monitoring Leads in the Lower Columbia Estuary at Lower Columbia Estuary Partnership | Portland, Oregon, United States

Dr. Sarah Kidd, Sineha Rao, and Ian Edgar are with the Lower Columbia Estuary Partnership. They are responsible for coordination, monitoring, and data management for numerous restored wetland sites throughout the lower...

[Read more](#)

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Lower Columbia River Estuary - Emerald Ash Borer Potential Impacts to Habitat

Dashboard by Ian Edgar and Dr. Sarah Kidd from Land Cover data provided by Keith Marcus, UCEP

The emerald ash borer, also known by the acronym EAB, is a green-buprestid or jewel beetle native to northeastern Asia that feeds on ash species. Females lay eggs in bark crevices on ash trees (*Fraxinus latifolia*), while the larvae feed underneath the bark of ash trees to emerge as adults in one to two years. It is predicted to cause large-scale devastation to the ash forests of the PLEW. Understanding the full potential area of impact is vital for both trading ecosystem health and informing future restoration practices. This map assesses impact in any location ash trees may be found, further research is needed to refine these analyses.

Click on the images to the left to see WL and GR response plans or to view a presentation from Curtis Helm for additional information on the potential impacts from the Emerald Ash Borer.

Map Based on 2009 High-Resolution Land Cover Classification Data
Click on a category (hold ctrl while clicking to select multiple categories) in the upper table to isolate and calculate the areas within the dynamic lower table.

Total Area of Potential Impact Zones

Category	Classification	Area (sq. feet)
Potential impacts from Emerald Ash Bore	contiguous upland forest	30,000
	contiguous wetland forest - likely impacted	1,000
	contiguous wetland forest - likely impacted	1,000
	contiguous wetland forest - likely impacted	1,000
	contiguous wetland forest - likely impacted	1,000
	contiguous wetland forest - likely impacted	1,000
	contiguous wetland forest - likely impacted	1,000
	contiguous wetland forest - likely impacted	1,000
	contiguous wetland forest - likely impacted	1,000
	contiguous wetland forest - likely impacted	1,000
Total		120,000
Unlikely to be directly impacted by Emerald Ash Bore	Agriculture	10,000
	agriculture	10,000
	Barren	10,000
	Barren	10,000
	Barren	10,000
	Barren	10,000
	Barren	10,000
	Barren	10,000
	Barren	10,000
	Barren	10,000
Grand Total		470,000

Classification Isolation

contiguous wetland forest - likely impacted	3,000
Grand Total	3,000

© 2022 Mapbox. © OpenStreetMap contributors

Potential Impact Areas
■ Potential impacts from Emerald Ash Borer
■ Unlikely to be directly impacted by Emerald Ash Bore

Tableau Example: AEMR Hybrid Report

- **Executive Summary, Methods, and background** remain in a **separate, traditional** document
- Stand-alone tableau dashboards with **results and discussions**
- **Executive summary** remains in both
- Circular links in both the document and the dashboards



North Unit Ph 1 Ruby Project Overview Map



This Dashboard Provides a Brief Methods Overview and Links to all the Results Summaries: Click any of the buttons below to access more data.

[Navigate to Hydrology data](#)

[Navigate to Sediment Accretion and Erosion](#)

[Navigate to Soil Development](#)

[Navigate to Vegetation Development](#)

[Navigate to Macroinvertebrate Communities](#)

Action Effectiveness Monitoring for the Lower Columbia River Estuary Habitat Restoration Program

habitat complexity.

Project objectives: The project aims to improve habitat quality and of the Slough and reducing the native wetland mix, and maintain habitat quality.

Construction actions: The project includes construction actions such as channel enhancements, strategic vegetation enhancement, habitat opportunities, structure and channel site, increasing periodic plain lowering to target Cunningham Lake and of a native vegetation which reduces the channel.

North Unit Ph 1 Ruby site is Cunningham Lake

Executive Summary

In the eight years since the disconnected lake into the habitat accessibility, the data mirror those observed. The water control structures are inaccessible to salmonids, accessible 85-78% of the time. Cunningham Lake (EM) with elevated temperatures, accretion at Ruby is expected. The high marsh elevation also found to be consistent with the lower ORP zone, with lower ORP primarily a low marsh. Ruby Lake - South where vegetation cover remains low. plant cover at Ruby Lake much of this being an exposed, scraped-down low marsh. The site has increased from 10% to site levels of 20% Water, however, an abundant

Tableau Example:

Trends in sediment accretion and erosion and Implications of SLR in tidal wetlands of the LCRE

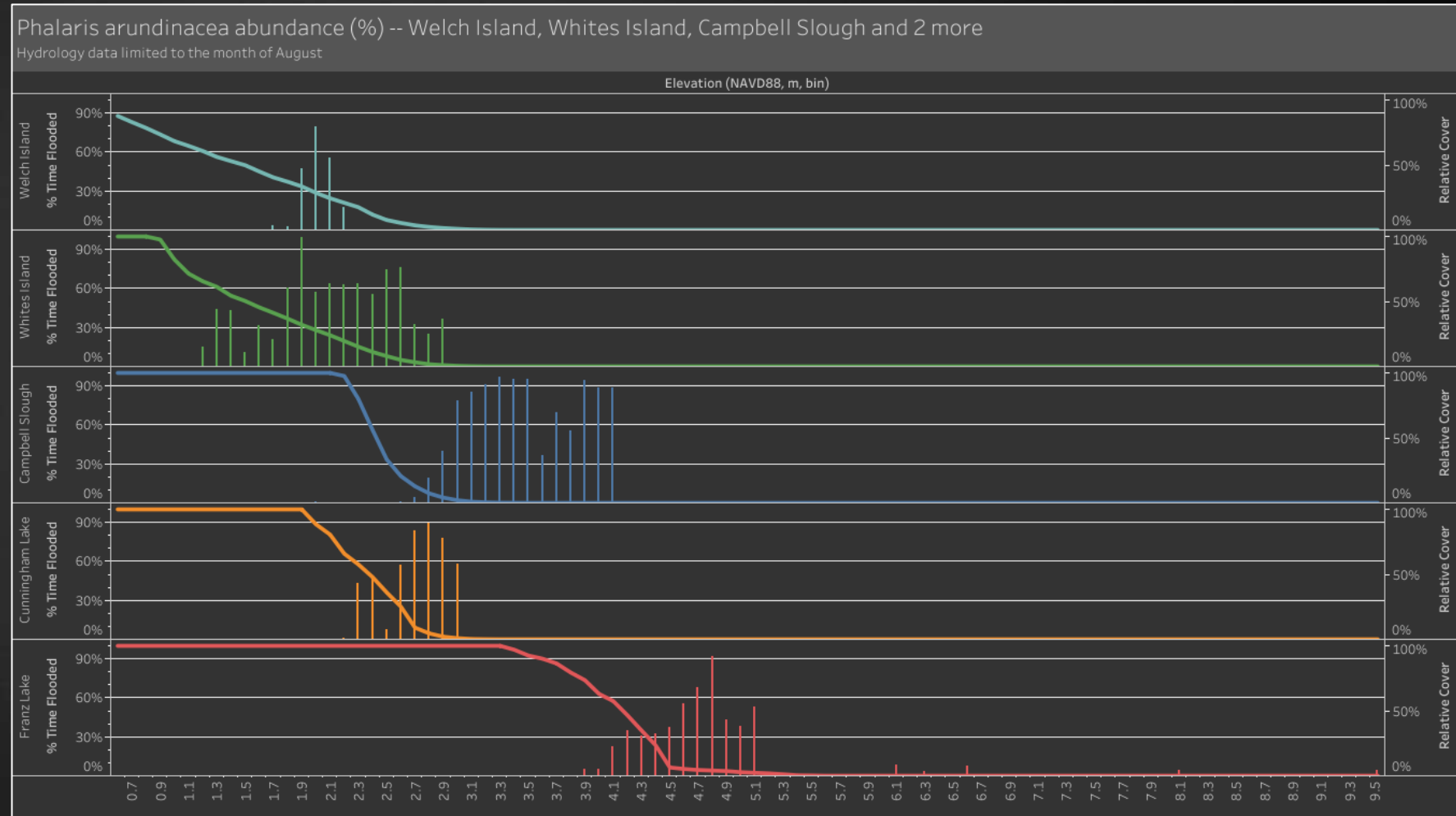
- ▶ Net Accretion/Erosion rates of trend sites were compared to Sea Level Rise Scenarios.
- ▶ USACE's 2020 Lower Columbia River Adaptive Hydraulics (AdH) Model Scenarios
- ▶ Each site, except for Franz Lake, is accreting slower than the most extreme forecasted sea level rise scenarios.



Tableau Example:

Ecological drivers of Reed canarygrass dominance across in the lower Columbia river estuary

- EMP data through 2021 continues to confirm hydrology as a critical driver for Reed Canarygrass abundance.
- In addition to hydrology, soil chemistry, such as Salinity and ORP influence reed canary grass dominance across reference and restored sites.



Summary of Next Steps



Transition all datasets into Tableau

Focusing on creating quick and useable databases for all metrics



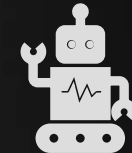
Full synthesis analysis of AEMR and EMP metrics

Habitat, Macros, Fish
Compare and analyze all metrics at the estuary wide scale, across each reach, and each site.



Drone Inclusion

Orthomosaic basemaps for each site using Mapbox
Full site wide statistics and analysis based on drone data



Full synthesis analyses of all sites and all metrics

Focus on the drivers and impact of each metric
Utilize predictive modeling to further inform upon the estuary



LOOK AT EXAMPLES ONLINE

- ▶ Our AEMR Report Page (With examples – no login required):
<https://public.tableau.com/app/profile/aemr.epmonitoring>
- ▶ Our Tableau Public Page (With examples – no login required):
<https://public.tableau.com/app/profile/sarah.ann.kidd>
- ▶ Watch April 2022 SWG introduction to Tableau Presentation:
<https://youtu.be/ExDxspBfsJo>
- ▶ Contact us if you are having any issues or questions:
- ▶ Sarah Kidd – skidd@estuarypartnership.org
- ▶ Ian Edgar – iedgar@estuarypartnership.org
- ▶ Sneha Rao – snehar@estuarypartnership.org

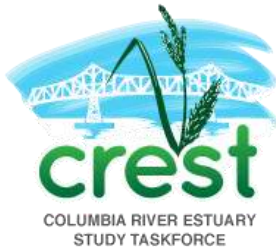


RESEARCH PARTNERS

THANK YOU



COWLITZ INDIAN TRIBE



Schott & Associates, Inc.



Institute for Applied Ecology



April Silva, CREST